NOV 24 1941

ENGINEERING NEWS-RECORD

NOVEMBER 20, 1941

oring problems feature construction of four-story parking garage under San Francisco's Union Square.

Subway Soil Pressures Measured
Belts Handle Drydock Concrete
Brick Masonry Design Studies
Steel Columns of Record Size

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Vol. 127 NOVEMBER 20, 1941 No. 21

THIS WEEK

• Brick masonry design problems are discussed from the viewpoint of a structural engineer, covering questions of girder concentrations, wall stability, effect of buttresses and pier dimensions. The author criticizes rule-of-thumb method used today, proposing a new method of proportioning lintels, and describes a "hybrid" steel-frame construction.

• Columns at mid-span weighing 250 lb. per ft. and designed to resist wind loads on a 100x66-ft. wall area are features of a 400x1,000-ft. Navy aircraft plant described in this issue. Each column also carries one end of the adjacent 200-ft.-span roof trusses.

• Highlights of the American Public Works Association Congress, held at New Orleans, Oct. 26–29, featuring discussions of defense and post-defense problems of interest to the engineering profession, will be found on page 91.

THINGS TO COME

• Lining 85 miles of the Delaware Aqueduct has assembled on one line the most advanced methods and equipment so far devised for forming and placing concrete tunnel lining, including telescoping forms and continuous pours. Some concrete mixed by double-drum pavers. Description of this work will appear in Dec. 4 issue.

• For size and boldness of the operation, construction of the 150x1,100-ft. Navy graving dock at Long Beach, Calif., being built in the dry, is without precedent. Deep wells were used to control underground water, aided by wellpoints in the side slopes, with 50 small pump units for unwatering. The project will be described in an early issue.

• Latest developments in principles and practice of making cement in concrete mix more effective through use of dispersing agents will be discussed in the Dec. 4 issue.

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Number of copies of this issue printed: 36,300

MORE LIGHT FOR NIGHT DRIVING

from New Reflecting Safety Curb

These pictures of New York State Highway tell story of greater visibility and traffic safety assured by White Concrete Reflecting Curb

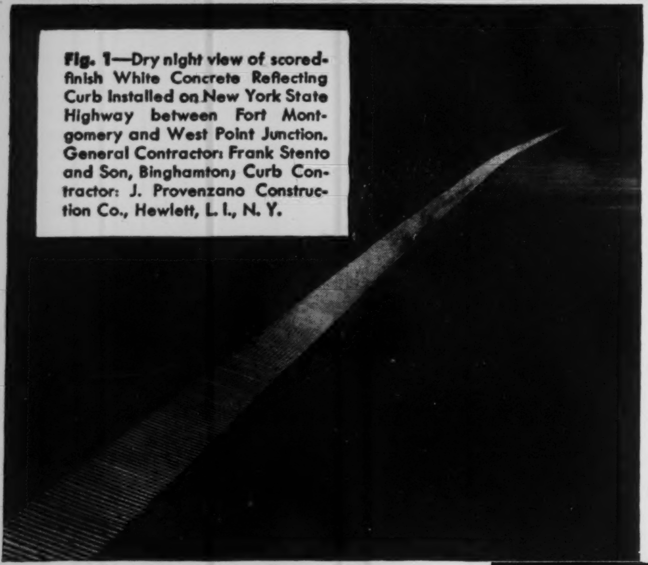

Fig. 1—Dry night view of scored-finish White Concrete Reflecting Curb installed on New York State Highway between Fort Montgomery and West Point Junction. General Contractor: Frank Stento and Son, Binghamton; Curb Contractor: J. Provenzano Construction Co., Hewlett, L. I., N. Y.

WHY White Concrete Reflecting Curb is an important contribution to safety on roads and streets is clearly shown in these two photographs.

On a dry night, under car headlights only—no other illumination—White Concrete Reflecting Curb defines the road far ahead of the car. Why? Because the white concrete is a good reflector, and because the saw-tooth faces of *reflecting* curb (as explained in Figs. 3 and 4) make the curb highly visible by reflecting the headlight rays back to—not away from—the driver.

On a rainy night, when the pavement is almost completely blacked out, *reflecting* curb provides a brighter guide to safety than on a dry night. Why? Water on the reflecting faces fills in the minor depressions in the white concrete, creating a smoother, more mirror-like surface which reflects even more light back to the driver and thus makes the curb even more highly visible.

White Concrete Reflecting Curb made with Atlas White cement has proved its efficiency and economy in many installations. Although relatively new, it has been installed or specified in 16 states.

WHY REFLECTING CURB IS HIGHLY VISIBLE

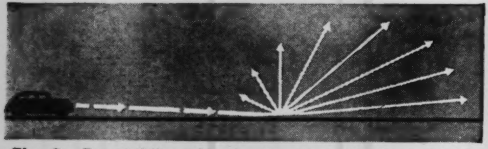

Fig. 3—For visibility of curb, *direction* of reflected light is as important as the *amount* of light. Car headlights strike *smooth* curb or pavement at a flat angle, and thus nearly all the light is wasted—it is reflected forward, in the *wrong* direction, away from driver. Visibility is poor, and on rainy nights is almost nil.

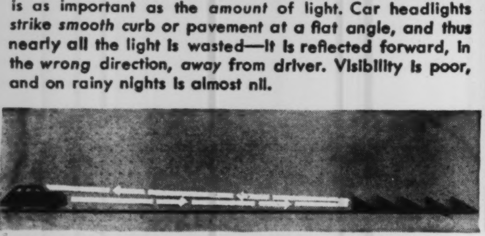

Fig. 4—When car headlights strike the saw-tooth faces of reflecting curb, the light is conserved—it is reflected in the *right* direction, back to the driver, forming a bright guide to safety. Visibility is high on dry nights and higher still on rainy nights (explained above, right).

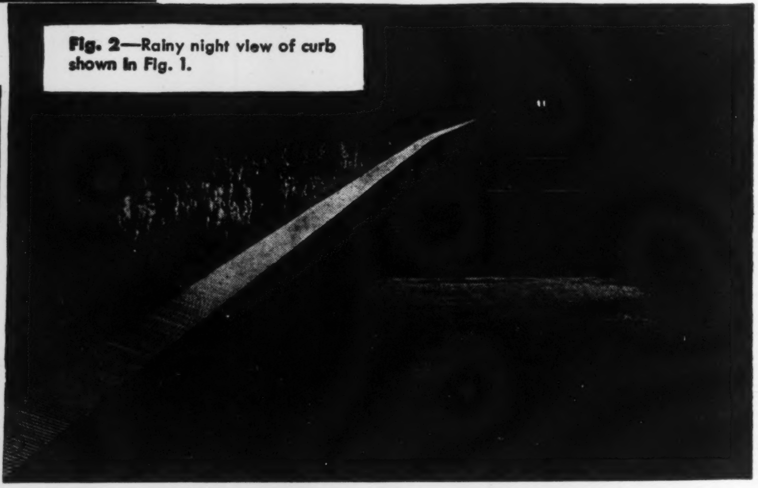

Fig. 2—Rainy night view of curb shown in Fig. 1.

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ENR-M-26

The Week In Engineering and Construction

ENGINEERING NEWS-RECORD • NOVEMBER 20, 1941

Defense construction crowds $8 billion

Military work represents 53 percent according to OPM figures, with another billion to be scheduled

Defense construction scheduled during the fifteen months from July 1, 1940 to October 1, 1941 amounted to $7,958,203,000 of which $3,647,426,000 worth or 46 percent was completed. The figures are from the latest report of OPM's Bureau of Research and Statistics which also reveals a number of other significant facts both on accomplishment and construction prospects.

The military portion of the scheduled program, according to OPM, totals $4,649,793,000 of which 44 percent is complete; and of the non-military defense construction $3,308,410,000 or 48 percent is finished. The accompanying table breaks down the 8 billion dollar program by type of construction, the value of the work in place, and the amount and percentage of construction unexpended.

It is expected that another billion dollars worth of projects will be scheduled by the end of this year, bringing the volume to $9,000,000,000 for the 18-month period.

Present estimates anticipate a further $6,000,000,000 expenditure for defense construction during 1942, with $2,250,000,000 being scheduled for erection of government-financed industrial facilities, and approximately $3,750,000,000 for direct military construction. These figures are based on current estimates for the present military force, any increase in which would increase the program.

OPM estimates a decrease of 65 percent in non-defense construction for next year. This drop may be cut to 50 percent, however, if defense housing is included in the non-defense category.

Despite the bleak outlook for non-defense projects in 1942, the construction volume as a whole is expected to attain the highest peak for any year since 1930, with the single exception of 1941.

• • •

Big cantonment program in new defense measure

Authorization of expenditure of $435,000,000 for an expanded cantonment program is called for in a request for $6,687,000,000 additional defense funds sent to Congress by the President as this issue goes to press. Survey and plans for twenty-five additional cantonments were made by the Army during recent months, hence the work is ready for contract as soon as the expenditure is authorized.

• • •

Portland-Montreal pipeline in operation

The first oil pipeline to be constructed as a defense project (*ENR*, Aug. 28, 1941, p. 285) from Portland, Maine to Montreal, Quebec, was officially dedicated last week.

Start of operations climaxed 132 days of feverish construction by employees of the Portland Pipeline Co. and the Montreal Pipeline Co. Ltd., contractors for the 236-mile line. The first run of oil was carried from Portland to North Waterford, Maine, where the first pumping station is located.

The Defense Construction Program[1]—As of October 1, 1941

(Thousands of dollars)

Type of Construction	*Total Program July 1, 1940-October 1, 1941*	*Value in Place October 1, 1941*	*To be Expended October 1, 1941*	*Percentage of Total Program to be Expended*
Total defense construction	7,958,203	3,647,426	4,310,777	54.2
Total military	4,649,793	2,065,421	2,584,372	55.6
Military housing	1,697,759	1,095,945	601,814	35.4
All other military construction	2,952,034	969,476	1,982,558	67.2
Government Financed Industrial Facilities (United States and British Governments)	2,207,230	1,073,635	1,133,595	51.4
Privately Financed Plant Expansion[2]	358,680	238,585	120,095	33.5
Defense Housing and Community Facilities	742,500	269,785	472,715	63.7

[1] Does not include data for construction programs which have not been reduced to a schedule basis.

[2] Under "accelerated depreciation" program, Second Revenue Act of 1940.

Torrance, Calif. quake does $600,000 damage

Ralph T. Taylor

Engineering News-Record Correspondent

A sharp local earthquake, which occurred in Torrance and Gardena, Calif., at 12:41 a.m. Nov. 14, caused no deaths nor serious injuries but resulted in property damage which may aggregate $600,000. Torrance, a center for steel mills and many other heavy industries, is located about 15 miles south of Los Angeles and about 5 miles from Gardena. Nearly all the important damage occurred in the towns of Torrance and Gardena although the failure of a large oil tank in Wilmington (Los Angeles Harbor), 5 miles distant, released a large quantity of oil into the streets. The epicenter of the disturbance has been tentatively located on the nearby Inglewood Fault, and it is estimated that the intensity was of the order of VII to VIII modified Mercalli scale at Torrance and VII at Gardena.

The business district of Torrance is largely of masonry buildings of one to three stories, and many of these suffered considerable damage, particularly those in which the masonry was not of first quality and in which the anchorage of timber framing was deficient or absent. Fallen parapet walls, cracked or shattered masonry, plaster damage and movement of walls or framing relative to each other were typical of the failures. In a few cases falling masonry from adjoining higher buildings caused collapse of roofs. Newer buildings with better design and workmanship suffered little, although plate glass breakage was extensive.

Some masonry flats and apartments suffered structural damage, but wood frame residences were unharmed. Schools built under present standards came through in good condition but some schools of earlier construction did not fare so well, and extensive reconstruction or replacement will probably be necessary. The industrial plants, generally, seemed to have suffered little damage as might be expected, most of the structures being typical steel frame mill buildings.

Except for temporary power failure there was no important interruption of utilities, and no serious damage to them has been reported. Damage to highways and streets was minor. The writer saw no evidence of failure of elevated tank towers. No surface faulting of the ground occurred. Some damage to gasoline tanks near Torrance was said to have occurred making it necessary to move some people temporarily from their homes because of the fire hazard.

Although the general character of the damage in Gardena was similar to that in Torrance, the amount was considerably less.

• • •

Over one billion spent on highways in 1940

Expenditures on state-administered highways in the year 1940 totaled $1,013,321,000, according to reports received by the Public Roads Administration from state highway departments. The disbursements were more than $200,000,000 above those in 1939, resulting largely from increases in motor vehicle use revenues. Receipts for both state-administered highways and local road and street work totaled $1,631,406,000.

Receipts for state-administered highways totaled $1,045,722,000 in 1940, which was made up of $754,479,000 from highway user taxes, $13,057,000 from appropriations, bridge and ferry tolls, property taxes and other imposts; $169,942,000 from federal sources; $89,989,000 from bonds and notes; and $18,305,000 by transfer from local governments and from miscellaneous sources. Construction expenditures on state-administered highways totaled $463,389,000 on primary roads; $30,274,000 on secondary roads under state control in 14 states, $26,905,000 on urban extensions of state highway systems in 24 states, and $2,217,000 on park and forest roads in 12 states. Maintenance expenditures totaled $215,093,000; $54,535,000 was spent for administration, engineering, equipment and similar items; $26,925,000 for state police; $65,828,000 for interest on state highway debts, and $128,155,000 for retirement of state highway bonds and other obligations.

• • •

New defense public works projects approved

To provide community facilities in defense areas for defense workers, personnel of the United States armed forces, and their families, 21 additional defense public works projects have been approved by President Roosevelt. These projects include schools, waterworks, hospitals and sewers, located in 14 states. The total estimated cost is $2,463,600.

Defense public works approved to date number 801, with a total estimated cost of $126,093,770, according to John N. Edy, acting federal works administrator.

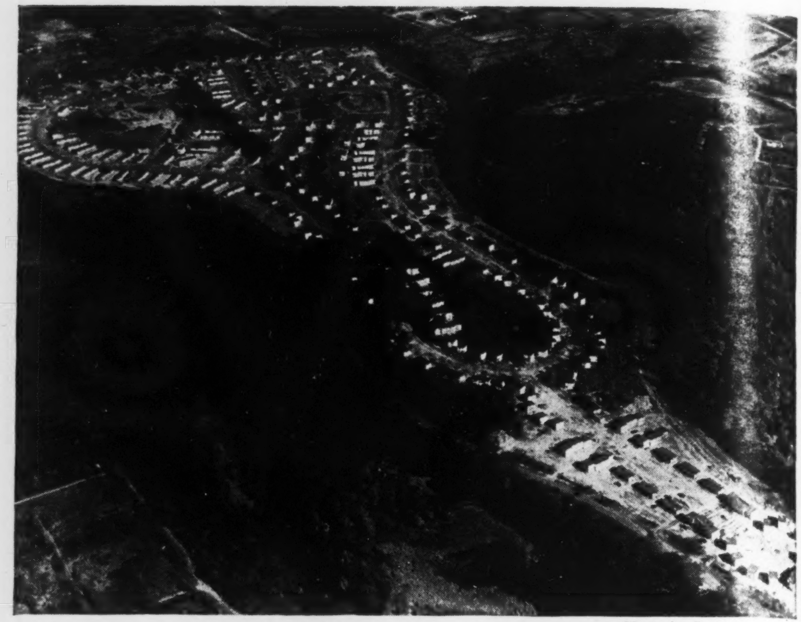


Photo by Earl W. Reinhold

Park living plan for defense housing

What the Federal Works Agency calls the "park-living plan" for defense housing communities probably finds its best expression in the Rahway River Park (N. J.) project completed early this month. A beautifully wooded site, bordered on one side by a county park and on the other by a small river, was laid out as shown in the photo to accommodate 254 houses. The 700 families occupying the houses will have the unique distinction of living in the only township in this country under federal control. The site was acquired by the Federal Works Agency following passage of a special act of the New Jersey state legislature creating the township of Winfield. This was done because the two communities in which the site is situated protested against locating a housing development of such size within their boundaries.

The project is one of the defense housing developments under the personal direction of Lawrence Westbrook, special assistant to the Federal Works Administrator, and originator of the "Camden plan" of home financing (ENR, May 22, 1941, p. 813). Contractor on the work was Clifford F. MacEvoy Co. of Newark, N. J., who completed the 254 frame houses at the rate of two a day by using a precut lumber and site assembly technique for erection. Details of the construction operations will be described in the Dec. 4 issue of Engineering News-Record.

PRIORITIES GUIDEPOST

Current notes on what, who and how

PRIORITY RATINGS ranging from A-2 to A-8 are being granted to community facilities projects undertaken under the defense public works program. Highest ratings are going to water, sewer and other utility projects and to access roads. Hospital and fire protection jobs get A-4 ratings and schools get A-6. Issuance of these ratings, like those for public defense housing, is being handled through the Federal Works Agency.

CONSTRUCTION contractors who do maintenance and repair work may now use an A-10 priority rating on orders for repair and maintenance parts for their own equipment and orders for operating supplies. This was accomplished last week by an amendment to Priorities Division's repair and maintenance order.

Construction contractors in general are still not entitled to use the repair and maintenance rating, but a further amendment bringing them in should emerge in the next few weeks. The present amendment originally was drafted to cover general contractors (*ENR*, Oct. 30, p. 3) but this feature was deferred for further study.

PRICES of most door, window and screen hardware and a few other miscellaneous types of building hardware have been frozen at the level prevailing on Oct. 21 by action of the Office of Price Administration. The price ceiling applies only to manufacturers' and jobbers' prices, but Administrator Henderson of OPA says he will see that retailers keep their prices in line with these levels.

Illinois Road Builders Association holds priorities clinic at Chicago

Speakers warn that critical materials must be conserved for defense needs. Governor Green pledges his support to modernization of trunk routes and elimination of road tax diversion.

An "Information, Please," round table discussion that naturally developed into a priorities clinic was the feature of the annual fall meeting of the Illinois Road Builders Association at Chicago Nov. 13. C. M. Hathaway, engineer of construction, Illinois division of highways, conducted the discussion; the board of experts answering questions was headed by R. H. Harrison, assistant engineer, Public Roads Administration, Burton Miller, assistant engineer director, American Road Builders Association, and Harry Lochner, assistant chief highway engineer, Cook County, Ill. Contractors, road engineers, material and equipment men fired questions at the board all afternoon. Mr. Miller, who came fresh from a conference with OPM at Washington for the occasion, and Mr. Harrison, through whom all Illinois highway priority matters are handled, bore the brunt of the questioning. Mr. Hathaway also revealed a surprising knowledge of priorities, and the group cleared up a lot of confusion and uncertainty concerning priorities existing in the minds of the audience.

The meeting included luncheon and dinner sessions. Walter Rosenfield, the new Illinois director of public works and buildings, addressed the noon meeting. He outlined the current year's highway program, $13.500.000 in contracts in ten months, and attempted to forecast next year's work, but admitted the situation depended a lot upon the fate of the road bill just passed by Congress.

Governor Dwight H. Green spoke at the dinner session. He is interested, he said, in providing Illinois with an efficient, safe and convenient system of highways, and with Director Rosenfield is making a study of modernization, maintenance and safe operation of 100,000 miles of state roads. Where roads are an immediate necessity, he pointed out, it is far better to acquire sufficient right-of-way for future widening, and it is wiser to devote time to consideration of traffic problems of interurban relationships than to plunge into plans that meet only necessities of the moment and involve greater expenditures in the future. The first objective, Gov. Green declared, is to proceed with modernization of trunk routes. He favors new construction, where practicable, to provide the needed safety features. The tendency is to bypass cities today, he said, but that does not mean highway engineers should ignore the traffic problems of cities and congested areas.

"I am a firm believer of financing highways on the user principle," the governor declared to the delight of the audience, "and upon that principle the unfortunate diversions of highway funds . . . . to other uses must cease." Cooperation of the division of highways with the national defense program is the paramount issue of the moment, he said. Defense highways must be capable of handling the military and defense industry traffic demanded of them, and Illinois will do its part to provide such roads, the governor said.

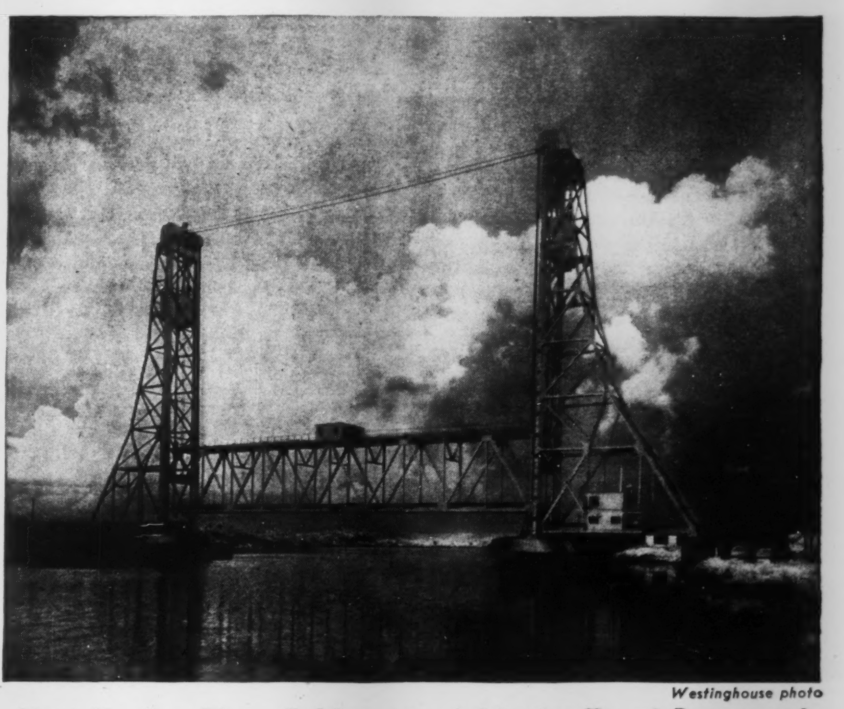
In introducing the governor, Otto Milburn, president of I. R. B. A., declared that "The strongest and most consistent force existing in the country today for preservation of private enterprise and initiative is the ever-lengthening chain of trade associations, such as I. R. B. A. United business men must stand, divided they may fall," he said.

All through the day's program speakers warned that critical materials must be conserved for defense needs. Cities, towns and counties were asked to consider the actual need of projects before submitting them to SPAB for priority ratings. All projects not absolutely needed at the moment should be deferred for post-war construction, it was pointed out time after time.

• • •

Greenbelt houses of USDA to be opened by Dec. 1

The U. S. Department of Agriculture announces that 152 new dwellings at Greenbelt, Md., the first of 1,000 now being built by the Farm Security Administration for defense workers in the Washington area, will be ready for occupancy by Dec. 1.



Westinghouse photo

New Neches River Bridge opened to traffic at Beaumont

A new single-track vertical-lift railway bridge, erected for the Kansas City Southern Railroad over the Neches River at Beaumont, Tex., has been opened to traffic.

The span is 245 ft., with towers 199 ft. above the pier level, and it has a clearance of 153 ft. above mean water level. The lift span is operated by a 75-hp. motor and control equipment, which raises the span 131.6 ft. in two minutes and 45 sec.

Howard, Needles, Tammen & Bergendoff, of Kansas City, were consulting engineers. A. N. Reece is chief engineer for the Kansas City Southern R.R. Co., and C. S. Heritage is bridge engineer. The steel superstructure was erected by the Kansas City Bridge Co.

Permanent prefabricated houses being considered

Possibility that builders of prefabricated houses will be given a chance to bid on defense housing projects considered as of permanent value was raised last week at a conference in Washington of government officials and prefabricators. To date, prefabrication methods of construction have only been applied to demountable houses, in projects which, it is thought, will not be useful after the war.

Prefabricators have resented this restriction of their product to temporary houses. For one thing, the demountable units constitute only a rather small fraction of the entire program—something like 10 percent in 1942. And in any case, the manufacturers feel that a prefabricated house can be just as permanent as any other, and they don't like having their houses associated in the public mind with demountability.

Several of the manufacturers raised this point at the conference, and Clark Foreman, director of defense housing for FWA, said that such a move is being seriously considered.

Primary purpose of the meeting was to propose to the manufacturers that they broaden the number of types of prefabricated house available. Last Spring, FWA laid down a standard two-bedroom floor-plan to which all designs were expected to conform. Now it is felt that five or six different floor plans should be available, both for practical reasons and to avoid monotonous appearance of projects. FWA asked each of the builders to submit designs, by the beginning of the year, covering five or six types.

It was agreed that orders would not be placed for any one type in lots smaller than 25 units.

• • •

FWA to move village of prefabricated houses

The Federal Works Agency is preparing to demonstrate for the first time in the history of housing that the removal of an entire village of prefabricated demountable houses to another locality is both practical and economical.

Early in December 186 dwellings will be demounted and moved from Indian Head, Md. to the marine base at Quantico, Va. The 186 dwellings are part of the 586 prefabricated, demountable housing units assigned by the Federal Works Administrator to the Public Buildings Administration for construction at Indian Head, to provide homes for civilian workers employed at the Navy's powder plant.

The seven contractors participating in the construction of the Indian Head project have been invited by FWA to submit bids for the contract to demount the 186 houses and transport them to Quantico. Bids will be opened about Dec. 1, and the moving job will be started shortly thereafter. It is expected that the government will save itself a half million dollars by moving these houses rather than constructing new ones at the Quantico site.

• • •

Water shortage continues in many Eastern States

A deficiency of stream flow centering in the Ohio valley, reported by the U. S. Geological Survey at the end of March (*ENR*, May 1, 1941, p. 712,) has extended to include most of the states in the Middle Atlantic and New England regions, according to the report of the Geological Survey for the 1940–41 water year ending Sept. 30. These deficiencies, which were marked by shortages in water supplies for power, municipal and industrial needs, stand in sharp contrast to the unusual rains and excess of stream flow in the southwestern group of states from Texas to California, as shown by the accompanying map.

Stream flow in a 290,000-sq.mi. area east of the Mississippi river centering about the Ohio River and extending through the Middle Atlantic region into New England averaged 55 percent of normal during the year. The annual yield of representative streams was the lowest on record. In power it accounted for the loss of about three billion kilowatt-hours of electric energy, an amount equivalent to 20 percent of the hydroelectric power generation in the same area during the previous year.

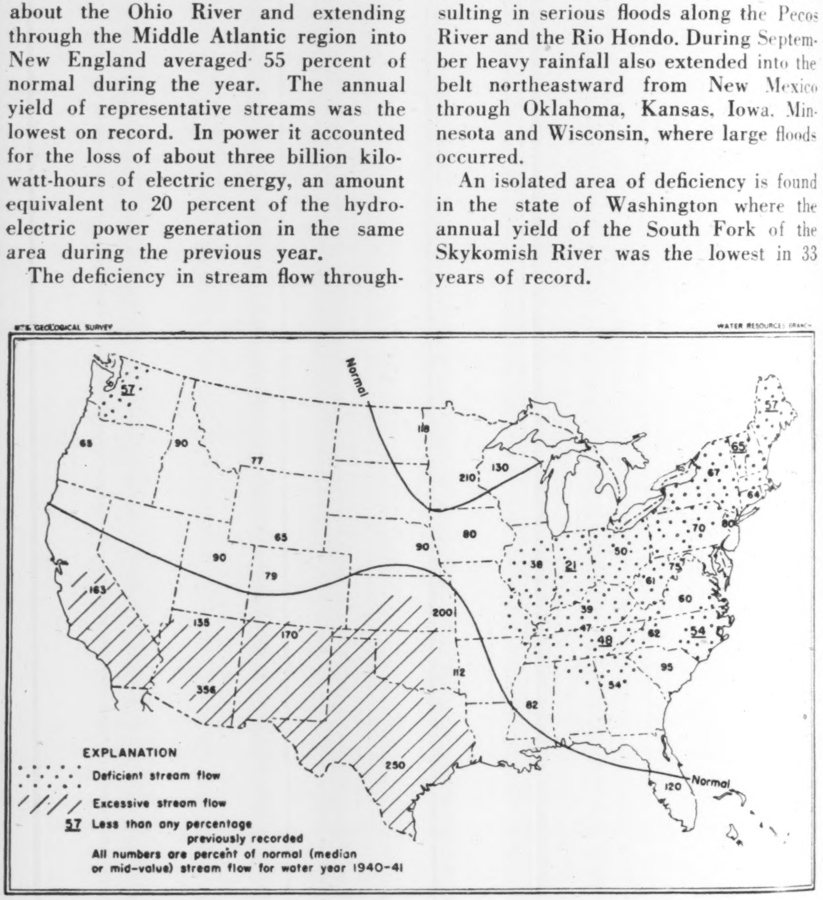
The deficiency in stream flow throughout the East accumulated gradually during the winter and spring. On April 1 the average deficiency in runoff over the critical area was 4.8 in. July was the only month during the entire water year in which there were no areas in the United States where stream flow was seriously below normal. At the close of the water year the average deficiency in runoff in the critical area was 8.0 in.

Groundwater levels in representative wells throughout the East are now generally below those of a year ago, with many at the lowest stage in nine years.

Throughout the Southwest, in the group of states from Texas to California, stream flow during the year ranged from 135 to 356 percent of normal, and in Arizona the greatest water yield since 1916 is indicated. Water levels in reservoirs reached all-time highs. In southern California plentiful groundwater supplies were indicated by the abnormal rise in the water level in the Baldwin Park well, indicative of prevalence of groundwater storage upon which so much irrigation in southern California depends.

Damaging floods along the Rio Grande in New Mexico in May and June were experienced as a result of snow melting coincidentally with heavy downpours. Rainfall over New Mexico in September was particularly severe, resulting in serious floods along the Pecos River and the Rio Hondo. During September heavy rainfall also extended into the belt northeastward from New Mexico through Oklahoma, Kansas, Iowa, Minnesota and Wisconsin, where large floods occurred.

An isolated area of deficiency is found in the state of Washington where the annual yield of the South Fork of the Skykomish River was the lowest in 33 years of record.



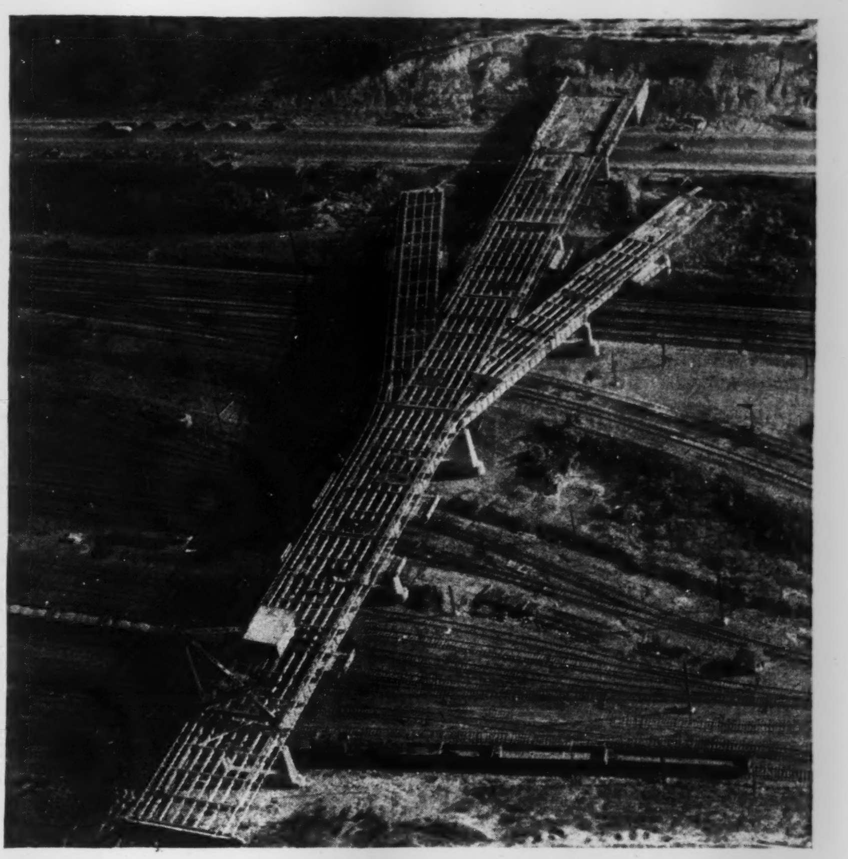
WASHINGTON HIGHLIGHTS

Berlin Dam Construction funds were requested by the President last week. He asked Congress to appropriate $2,335,000 for the $6,450,000 project, the remainder to be provided next year. Berlin Dam, on the Mahoning River in Ohio was strongly endorsed recently by OPM to regularize the supply of industrial water for steel mills downstream and protect them from floods.

Rentals for Dwellings in the District of Columbia are frozen at the levels prevailing Jan. 1, 1941 under the terms of a bill which has passed both houses of Congress and is now awaiting reconciliation of minor amendments. Rent levels for dwellings not rented on that date or during the preceding year would be set by an administrator at the level prevailing in the district for equivalent accommodations. The administrator would have power to modify the whole rent level if costs change and could also revise individual rents in special hardship cases. Tenants who pay more than the legal rent are entitled to recover double damages from their landlord.

Indications are beginning to emerge as to the form that pending reorganization of defense housing will take. Best guess as we go to press is that the complex aggregation of agencies now doing the work will be cut down to two. One, probably the United States Housing Authority, would deal with all construction of defense housing which is expected to have permanent value. USHA is considered to have established a better record on its share of the defense housing job than have any other of the agencies working on it. This move would tend towards closer correlation of the defense housing program with the New Deal's long-range slum clearance objectives. It is possible that USHA might get a new administrator in the re-shuffle. At the same time, temporary housing—demountable buildings, trailers, dormitories—might be handled through a second agency, perhaps the Division of Defense Housing recently set up under Clark Foreman in the Federal Works Agency.

Although priority aid to private defense housing would probably continue under such a set-up, less reliance would be placed on the private builder. In the past it has been the practice of the housing coordinator to "assign" a certain part of the defense need in each locality to private industry—that is, to hold the government program to the difference between the need and the estimated volume of private building. In future, the government programs are likely to be based more directly on the estimated need.



To get into (or away from) Washington more easily

The Pennsylvania and the Baltimore & Ohio railroads have nearly completed their share of the work on this highway bridge in Washington, D. C. Under a 30-yr. old law, which permitted the lines to bring their tracks through the District to the Union Station, the railroads are required to provide two highway crossings. This is one of them. The overpass will aid in carrying traffic from the central part of Washington out to connect with Route 1, which leads to Baltimore and New York.

The bridge is a built-up plate girder structure of seven spans, varying in length from 70 to 140 ft. It is carried on thirteen concrete piers and two abutments, founded on spread footings. The 12-ft. deep girders are continuous over the piers. Containing about 1,400 tons of steel, the bridge will carry a 40-ft. roadway and two 6-ft. sidewalks.

Paving is to be done by the District government, as is construction of the approaches. On the near side, the approach will carry to Brentwood Ave., which is to be widened to meet the increased traffic. At the far side, the bridge crosses New York Ave., one of the major routes out of town, to which it will be joined by ramps. Another approach on the far side will cross government land to join 6th St.

The railroads' share of the work is being done by the James McGraw Co. of Philadelphia under a $405,000 contract. Work started last April, and completion is expected in January. Bids have not yet been taken for the District work.

The bridge was designed by the engineering departments of the two railroads with W. D. Wiggins chief engineer for the Pennsylvania and A. C. Clarke for the B. & O.

A bolder, more ambitious government program of this nature was suggested last week when Sidney Hillman revealed that studies are now being made of a possible $50,000,000 housing program in Detroit. This would involve some 15,000 or more dwelling units and would be nearly three times the size of anything yet projected in one locality. Biggest local programs to date are at San Diego, where 4,500 houses are being built at a cost of $20,000,000; Pittsburgh—4,300 units costing 18,500,000; and Philadelphia—3,400 units costing $15,000,000.

Power curtailment in the Southeast has been deferred a second time, until Dec. 1. Effective Nov. 17, however, power consumers have been forbidden to use more power than they did during September.

Binger tells how Britain withstands its bombings

An audience that overflowed the largest facilities available in the New York Engineers Club stayed half the afternoon at a luncheon meeting on Nov. 12, to hear Walter D. Binger tell of his recent visit to Great Britain, and to ask him questions. Mr. Binger, commissioner of Borough Works of Manhattan, is chairman of the National Technological Civil Protection Committee, and on his trip abroad was a special representative of the Secretary of War. Armed thus with official credentials, he probably learned more of Britain's plans for civil protection than has any other visitor.

London's water mains include many ancient systems, some dating back to Queen Elizabeth's time. Modern systems have been built around or over these ancient systems, so that there are few locations in the old part of the city that are not served by multiple mains. Mr. Binger reports that these extensive water distribution systems were instrumental in saving London from fire, and the lesson for us to learn is to use cross-connections very liberally. Great Britain decided early in the war to make all repairs to its broken water mains permanent in character; temporary repairs, although they might have been made more quickly, would have necessitated tearing up the streets again. When a water main is bombed out, temporary lines are laid on the surface, made up of prefabricated pipe sections. These serve until the underground permanent repairs are in.

Many street shelters are being built. Because of a shortage of form lumber, walls consist of 14 in. of brick reinforced with vertical bars. Concrete slabs are used for floors and roof. No excavation is made for the floor slab, which is placed directly on the ground surface. With such a design the entire shelter can move under pressure from a bomb blast, whereas if it were anchored into the ground its walls would be shattered. The shelters may hold as many as 100 persons.

Bombed bridges, of which there have been very few, have been replaced by temporary steel or timber structures, made of standard prefabricated units.

In Mr. Binger's opinion there is no question but what the fireproofed, steel-frame building stands up best under bombing. Unfortunately, Britain has too few of these. Even plaster on metal lath used as fireproofing saved some steel-column buildings. In structures such as our skyscrapers, bomb shelters should be placed about three stories up, instead of in the basement. In such a location they are above the splinters from bombs exploding in the street and they are far enough below the roof to have reasonable protection from direct hits.

JOBS OF THE WEEK

PLANT, Milwaukee, Wis.

Allis Chalmers Mfg. Co., Milwaukee, Wis., awarded the general contract for a 1-story, 500x800-ft. building for manufacturing superchargers and for a 1-story, 80x200-ft. forge plant, to Siesel Construction Co., Milwaukee, Wis. The grading work was awarded to Marchese Bros., Inc., Milwaukee, and the railroad work to W. H. Knapp, Inc., Milwaukee. Estimated cost of the entire project is $775,000. C. E. Metzer, c/o owners, is the engineer for the project.

DUCHESNE TUNNEL, Utah.

Utah Construction Co., Ogden, Utah, was low bidder for constructing a section of the Duchesne Tunnel of the Deer Creek Diversion of Provo River Project with a bid of $1,156,105. Bureau of Reclamation, Provo, Utah, opened the bids Nov. 10.

ORDNANCE PLANT ADDITION, Independence, Mo.

Walbridge-Aldinger Co. and Foley Bros., Inc., Independence, Mo., were awarded a joint contract by the War Department, Washington, D. C., for constructing two 300x100-ft. brick buildings for the Lake City Ordnance Plant. The work is estimated to cost $2,000,000. Smith-Hinchman & Grylls, Detroit, Mich., are architects for the undertaking.

POWER PLANT, Devon, Conn.

Connecticut Light & Power Co., Waterbury, Conn., will construct a 45,000-kilowatt-hour power plant on the Housatonic River with its own forces. The job is estimated to cost $4,000,000.

SHIPBUILDING FACILITIES, Mare Island, Calif.

The Kaiser Co., Mare Island, Calif., will build additional ship building facilities at the Navy Yard for the Bureau of Yards & Docks, Navy Department, Washington, D. C. The work is estimated to cost $5,624,000.

WIND TUNNEL, Moffett Field, Calif.

Pittsburgh-Des Moines Steel Co., San Francisco, Calif., has been awarded a $5,202,320 contract for constructing a wind tunnel at Moffett Field for the National Advisory Commission for Aeronautics, Ames Laboratory, Moffett Field.

AEROPLANE MANUFACTURING PLANT, East Paterson, N. J.

Mahony-Troast Construction Co., Passaic, N. J., has been awarded the contract for constructing a 1- and 2-story, 415x450-ft. plant on Market St. and 215x235-ft. building, with a connecting bridge to the plant by Wright Aeronautical Corp., Paterson, N. J. Estimated cost $2,747,800 for the land and buildings is $2,747,800 and that for machinery and equipment $2,226,400. Albert Kahn, Inc., Detroit, Mich., is engineer and architect for the work, which the Defense Plant Corp. is financing.

NAVAL FACILITIES, Canal Zone.

Lindgren & Swinerton, Inc., San Francisco, Calif., Hegeman-Harris Co., 220 East 42nd St., New York, N. Y., and Tucker McClure, Inc., New York, N. Y., have been awarded a joint supplementary contract for building the additional facilities at the Naval Ammunition Depot, Naval Hospital, Naval Radio Station and Naval Operating Base, Balboa. The three firms will also build a submarine base and naval ammunition depot at the Naval Hospital, Naval Radio Station, at Coco Sola; the companies will also improve the National Airport at David and the Naval Radio Station at Summit. Bureau of Yards & Docks awarded the contracts, which calls for construction expected to cost $2,000,000.

POWER PLANT, Rockford, Ill.

Stone & Webster Engineering Corp., New York, N. Y., will design, construct and complete the addition for a power plant for the Central Illinois Electric & Gas Co., Rockford, Ill. Estimated cost of the work is $1,350,000.

DEFENSE HOUSING, Hatboro, Pa.

Anthony P. Miller and Anthony P. Miller, Inc., Atlantic City, N. J., have been awarded a $1,127,150 contract for 300 defense housing units by the Public Buildings Administration, Washington, D. C.

POWER PLANT EQUIPMENT, Denison, Tex.

S. Morgan Smith Co., York, Pa., will design, furnish and deliver two 56,000-hp. turbines for the Denison Dam powerhouse for the U. S. Engineers, Denison, Tex., under terms of a $1,134,801 contract. Woodward-Governor Co., Rockford, Ill., has been awarded a $60,935 contract for the governors.

ALUMINUM REDUCTION MILL, Troutdale, Ore.

Aluminum Company of America, Pittsburgh, Pa., will build with own forces, 100,000,000 lb. aluminum reduction plant. Estimated cost is $10,000,000. Defense Plant Corp. will finance.

NOTE—Additional bidding and contract news on over 800 projects large and small appear in Construction News sections beginning on page 138.

OBITUARY

Einar Weidemann, 64, engineer of bridges and buildings, Pennsylvania Railroad, western region, died in Chicago, Nov. 12. On May 5, 1909, he joined the Pennsylvania R.R. at Pittsburgh as a structural designer. On Jan. 1, 1916, Weidemann became associated with Joshua D'Esposito on the design and construction of the Chicago Union Station, first as structural engineer and later as engineer of bridges. Returning to the Pennsylvania as assistant engineer June 16, 1926, he was named engineer of bridges and buildings, western region, on Jan. 1, 1928, the position he held at the time of his death.

Lardner V. Morris, former chief engineer of the Long Island Railroad, died at Bristol, Pa., Nov. 16. Mr. Morris had been with the Long Island Railroad since 1902, until his retirement in 1933. He succeeded J. R. Savage as chief engineer in 1917 and held that position until 1926, when he was promoted to the post of consultant engineer. From 1914 on Mr. Morris, in addition to his other duties, was valuation engineer for the railroad. He was 71 years old.

Frederick J. Thielbar, 75, died Nov. 15 at Chicago, Ill. Mr. Thielbar started his career in Chicago in 1892 with the firm of Holabird & Roche, architects, as superintendent of construction. He later became general superintendent and when he left the firm in 1918 he was a junior partner. From 1918 to 1921 he was in private practice. In 1925 he joined John R. Fugard to organize the firm of which he was a member at his death.

Arthur S. Lyon, 58, assistant engineer in the Kansas state highway landscape architect's office, died Nov. 7 at Topeka, Kan. He had been employed by the highway department since Feb. 1, 1934, and has been assistant engineer since Sept. 1, 1937.

George McKay Hudson, 58, construction superintendent for the Player Realty Co., died at Fayetteville, N. C., Nov. 8.

John J. English, president of the Wilson & English Construction Co., railroad contractors, died Nov. 8 in New York City. Mr. English was 74 years old.

Sheridan J. Broomall, 73, president of the Broomall Construction Co., died Nov. 5 at Salem, Ohio.

Charles Peterson, 57, superintendent on marine work for Merritt-Chapman & Scott Corp., marine contractors, died Nov. 8 at Cleveland, Ohio.

Herbert G. Haenling, 44, engineer, died Nov. 11 at Auburn, N. Y. Mr. Haenling served overseas with the 16th Engineers in the World War.

Loring N. Farnum, retired civil and consulting engineer, died Nov. 13 at Pelham, N. Y. He was 73 years old. Mr. Farnum was engaged in hydraulic and railroad work from 1890 to 1907. He was vice president of J. G. White & Co., New York engineering firm, from 1907 to 1911, and was associated with the firm until 1930.

Aubrey Carter, 47, general contractor, died recently at Cincinnati, Ohio.

Thomas Frederic Boston, 65, engineer, died Nov. 11 at Alliance, Ohio. Mr. Boston was employed by the Morgan Engineering Co.

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C. & O. Railway to drive long Virginia tunnel

The Chesapeake & Ohio Ry. has announced plans for construction of a new tunnel through the Blue Ridge Mountains between Afton and Waynesboro, Va. A 4,200-ft. long bore is planned to replace an 83-year old tunnel now carrying the railway's mainline traffic through the mountain ridge.

CONTRACTS AND CAPITAL

Engineering Construction awards for the short week due to the early closing for the Thanksgiving Day holiday total $64,100,000, a decrease of 14 percent from the volume reported for the corresponding 1940 week.

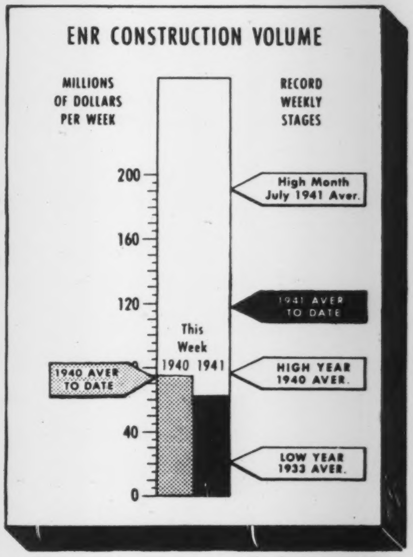
Private awards are 7 percent higher than in the week a year ago, but public construction is 19 percent lower, due to a 24 percent decline in federal work, and a 2 percent decrease in state and municipal awards.

The week's total brings 1941 construction to $5,488,679,000, an increase of 57 percent over the volume for the 47-week period last year. Private construction for the period, $1,104,546,000, is up 7 percent, and public construction, $4,384,133,000, is 77 percent higher as a result of the 171 percent gain in federal work.

In the classified construction groups, gains over the 1940 week are in briges, industrial and commercial buildings, earthwork and drainage, streets and roads, and unclassified construction. Comparisons with last week show increases in sewerage, industrial and commercial buildings, earthwork and drainage, streets and roads, and unclassified.

New capital for construction purposes for the week totals $12,686,000, a gain of 230 percent over a year ago. The current week's new financing is made up of $8,342,000 in corporate security issues, $3,844,000 in state and municipal bond sales, and $500,000 in RFC loans for public improvements.

New construction financing for the year to date, $6,258,369,000, is 74 percent greater than the $3,600,879,000 reported for the 47-week period in 1940.



CONTRACTS

(Thousands of dollars)

	Week Ending Nov. 21 1940	Nov. 13 1941	Nov. 20 1941
Federal	$48,212	$97,210	$36,875
State & Municipal	12,487	16,360	12,242
Total public...	$60,699	$113,570	$49,117
Total private..	13,958	16,590	14,983
TOTALS	$74,657	$130,160	$64,100

Cumulative
1941......(47 weeks).....$5,488,679
1940......(47 weeks).....$3,499,236

Note: Minimum size projects included are: Waterworks and waterways projects, $15,000; other public works, $25,000; industrial buildings, $40,000; other buildings, $150,000.

NEW PRODUCTIVE CAPITAL

	Cumulative 1940 47 weeks	1941 47 weeks
NON-FEDERAL	$1,318,918	$1,307,251
Corp. Securities....	223,640	347,119
State & Mun.......	456,670	396,202
U.S.H.A. loans	218,704	30,399
R.F.C. loans.......	195,904	270,031
R.E.A. loans.......	40,000	100,500
Federal Aid—Hwy..	184,000	163,000
FEDERAL	$2,281,961	$4,951,118
TOTAL CAPITAL....	$3,600,879	$6,258,369

FHA MORTGAGES

	Week Ending Nov. 16 1940	Nov. 8 1941	Nov. 15 1941
Selected for appraisal ... (Titles II and VI)	$20,136	$22,330	$19,991*

Cumulative
1941.....(46 weeks).....$1,287,214*
1940.....(46 weeks).....$1,147,145

* Subject to revision.

ENR INDEX NUMBERS

Index Base=100		1913	1926
Construction Cost...	Nov. '41..	266.13	127.93
Building Cost......	Nov. '41..	216.54	117.05
Volume	Oct. '41..	263	115

Comment and Discussion

Readers' opinions on matters that concern engineers and contractors

On Curtailing Construction

Sir: During this national emergency the construction industry cannot expect and does not expect any preferential treatment. However, it ought to expect and to demand consideration equal to that given to other industries which are not absolutely essential to national defense. For instance, if automobile production, manufacture of washing machines and radios are curtailed, then non-defense building ought to be curtailed in exactly the same proportion and extent. If all non-essential manufacture is eliminated, then and only then, should non-defense construction be thoroughly stopped.

It certainly will be the height of folly and the worst sort of discrimination if non-defense building is entirely stopped and other lines of non-defense activities are allowed to continue at a reduced rate. It would be even worse if construction by WPA is allowed to continue while the construction industry is made to wait idly by without any opportunity to earn its living. In other words, the effect of such a ban on non-defense construction would be to throw all the construction industry, not employed on defense work, over on the WPA.

In our opinion, curtailment of non-defense construction work at this time which does not effect the curtailment of other industries would actually be beneficial to the construction industry. Building costs are inflated at this time, which means that owners of buildings now being erected will have investments later on which may not carry themselves. Such a ban on construction now would mean that a large backlog of demand for all types of construction would accumulate, so that when this emergency is over the construction industry would not be in an overproduced business and would have something to fall back on.

Of course a large amount of construction can continue and will continue as it will utilize material on which there is no priority, such as lumber, clay products, lime, cement, plaster, etc. If the government will provide the opportunity for securing nails, farm building can continue. Electric wiring and plumbing can be installed later.

The construction industry performed marvelously when called upon last fall by the government and it will continue to do all that it is asked to do, but it should not be discriminated against as regards other types of employment and manufacture which are not essential.

EDWIN L. JONES
J. A. Jones Construction Co.
Charlotte, N. C.

Saving Steel

Sir: Arthur H. Brewer is to be commended for his timely article, "Designing to Save Steel," in your issue of Nov. 6, p. 669. I may add that much study has been given during recent months to the economics of design of steel structures as affected by the national emergency and wherein the design criterion is not a saving in cost but a saving in structural steel.

Mr. Brewer's suggestion that "consideration might be given to the rolling of fewer of the wide flange sections," is actually carried out in OPM's recommended simplified list of structural sections, which appeared in *ENR*, Oct. 30, 1941, p. 622. The American Institute of Steel Construction has also been requested by OPM to assist in the wide distribution of this simplified list to designers and others, and copies may be obtained on application to its various offices.

In Mr. Brewer's article reference is made to an obvious saving in steel, possible by the use of the "most economical section." The AISC Manual of Steel Construction has included since 1933 section modulus tables for sections used as beams. These tables have recently been amplified and are presented in the latest edition of the Manual, just off the press. Standard beams and channels, wide flange beams, light beams rolled on wide flange mills and other miscellaneous sections are included, but now will be temporarily subject to the restrictions as to sizes and weights set by the OPM. These restrictions, however, do not affect the sections regularly used in building construction.

Mr. Brewer says "steel saving is reflected in dead weight saving." As the dead weight of a building is obviously meant, then it is equally obvious that it is the dead weight saving (floors, walls, and partitions, etc.) that results in a steel saving—the reverse of his statement.

F. H. FRANKLAND
Director of Engineering
American Institute of Steel Construction

More About Pipe Flow

Sir: In answer to Professor Gordon M. Fair's letter (*ENR*, Oct. 9, 1941, p. 479) concerning my article "Flow in Pipe Networks by Direct Determination" (*ENR*, Sept. 11, 1941, p. 370) I may state that it was not my intention to cast aspersion on the offspring of any parent but to offer what appeared to be a reasonable method of attack on an old problem.

In the example cited in Prof. Fair's letter, there apparently occurs the condition of two reentering branch lines, each of which consists of a compound pipe. This merely necessitates the determination of an equivalent diameter for each individual line. If such "discrimination" is exercised, it is quite evident that equality of diversion will result from the use of my method and no error of 70 per cent.

I wish to reiterate that the method has been presented as a preliminary process only and not as a "cure-all" nor a criticism of the very complete methods of analysis heretofore developed. However, I do believe that economy of time may result from its use in many instances and that a reasonable amount of care should suffice in the avoidance of any pseudo or real "pitfalls."

JAMES A. CONKLIN, C.E.
Superintendent of Water
Ramsey, N. J.

Sir: James A. Conklin has proposed a very sensible and practical time-saving method for obtaining the first approximation of flows in a pipe gridiron in his article, "Flow in Pipe Networks By Direct Determination" (*ENR*, Sept. 11, 1941, p. 370). The title of the paper is somewhat misleading as it suggests that the method gives a direct answer. The text clearly shows that the method is for determining the first approximation of flows, rather than exact values.

Schoder and Dawson (*Hydraulics*, McGraw-Hill Book Co.) employ the $h^{\frac{1}{2}} d^{5/2} L^{-\frac{1}{2}}$ relationship in solving a loop problem where the loss-of-head is the same for the two lines. They also point out that a small percentage change in the diameter corresponds to 2.5 times that percentage change in Q, while a small percentage change in the head causes one-half that percentage change in Q. By dropping out the loss-of-head from his flow factor Mr. Conklin eliminates the unknown value, which causes no error if the loss-of-head in two lines investigated is the same, and an error in the flow factor of only half that in the loss-of-head when these are not the same. In many gridiron problems the losses of head in two adjacent lines do not vary enough to cause a tremendous error, as shown by the example Mr. Conklin worked out in his paper.

The example given by Professor Fair (*ENR*, Oct. 9, 1941, p. 479) shows that Conklin's method is exact when the loss of head in two lines is the same. In this network, consisting "of a square in which water flows (1) in a clockwise direction through a 24-in. pipe that is followed by a 12-in. pipe, and (2) in a counterclockwise direction through a 12-in. pipe that is followed by a 24-in. pipe . . ." the system consists of a loop of compound pipes to which Conklin's method should be applied as follows, assuming length of each size pipe at 1,000 feet:

Clockwise circuit, Q factor $= 2^{5/2} + 1^{5/2}$

Counterclockwise circuit, Q factor $= 1^{5/2} + 2^{5/2}$

The flow is correctly shown to be equal in each branch.

For approximate determination of flow factors, a diagram or nomograph should be adequate.

Weston Gavett
Plainfield, N. J.

Sir: In commenting upon the article by James A. Conklin, the writer may have done Mr. Conklin an injustice by taking too seriously the title of the article, which may not have been of his own choosing. As a means for obtaining a first approximation of flows, Conklin's method has much to commend it. How far it may depart from being a direct determination, however, was shown in the writer's previous letter. Mr. Weston Gavett obtains an exact answer for the writer's example by treating the clockwise and counterclockwise members of the simple pipe system as compound pipes. This is a recognition of the fact that the application of Conklin's method is inadequate in situations such as this.

Gordon M. Fair,
Professor of Sanitary Engineering
Harvard University

Bomb Shelters for the Home

Sir: I have read O. Bondy's article, "Buildings Under Bombing" (*ENG*, Aug. 14, 1941) with great interest and notice how the article deals mainly with multiple story buildings. It is more important, in this writer's opinion, to make such provisions for individual homes so that the ordinary family can obtain ample protection. For such purpose, this writer suggested to the authorities in October, 1940, that in all new buildings built the cellar should be made into a bomb shelter, accomplished by having 12-in. thick reinforced concrete walls and ceiling. The bomb-proof cellar might be divided in three parts, where in general one part will be designed for living, one part for sleeping, and the third part will serve as the utility room. It will easily be seen that the first and third part of the proposed bomb-proof cellar will function permanently.

Such construction would be, of course, fireproof, and able to carry a load of over 1,000 lb. per sq. ft. as compared with a required design load of 60 lb. per sq. ft., which is the strength of present-day floors. Therefore, even if a building with a bomb cellar is wrecked or burned to the ground, the cellar will be intact, as the ceiling construction is strong enough to carry the load of débris of a caved-in building three or four stories high.

The cost of such cellars should not be excessive. For instance, in a home costing $10,000 one estimate places the cost of a bomb-proof cellar at $400 additional. The increased cost should be offset by advantages given the owner. For instance, if a special low-interest rate be charged on loans for houses with bomb cellars, it might be possible that the monthly charges will not be more than for an ordinary house.

Odd Albert
Assistant Professor in
Structural Engineering
Newark College of Engineering

Hiwassee Type Forms

Sir: *Engineering News-Record*, Oct. 23, 1941, p. 86, carried an article comparing the cantilever forms and so-called Hiwassee type forms used on Mahoning Dam. This article draws certain conclusions based on the experience at Mahoning Dam where both types of forms were used and states that the cantilever form was 10 percent cheaper to use, safer, and had less top movement than the Hiwassee type form.

The Hiwassee type form was designed by the writer of this letter and the form used under his general supervision at Hiwassee Dam. In order that the readers of *Engineering News-Record* may have a true picture of this comparison, I would like to point out a few facts concerning the forms used at Hiwassee.

1. The cost comparison is undoubtedly correct, as indicated by the experience at Mahoning Dam, but this comparison is not indicative of the costs to be expected by using the Hiwassee form as originally designed. A comparison of the forms used on Hiwassee Dam with the forms used at Mahoning Dam can be made by reviewing the plans of the original Hiwassee form described in an article published in April, 1940, *Construction Methods*, under my signature. I am sure you will agree that there is a decided difference in the original Hiwassee form and the one used at Mahoning.

2. With reference to the safety of the two forms, we sustained one partial permanent injury to one carpenter engaged in handling the forms for 800,000 cubic yards of concrete at Hiwassee Dam, because a bolt was removed from one of the templet pipes, allowing him to fall and injure his heel. This was the only serious accident sustained in handling all carpenter work at Hiwassee.

3. Due to the change in design of the so-called Hiwassee forms used at Mahoning Dam, it is possible that top movement was experienced. Our experience in using the original forms at Hiwassee was entirely different and top movement was negligible. It would be very interesting to have a comparison of the lines of the two dams.

J. E. Walters
General Construction Superintendent
Marshall Ford Dam, Texas
Formerly Supt. of Construction for TVA
Hiwassee Dam, North Carolina

EDITORIALS

VOLUME 127 NUMBER 21

November 20, 1941

Defense Road Funds

A MODIFIED DEFENSE ROAD BILL is now before the President, modified to meet his principal objections to the bill that he vetoed earlier in the year, but at the same time maintaining the principle under which federal aid to state highway work has been provided for so long. Significant in this latest bill is the change in the federal-state ratio of participation from 50-50 to 75-25, not only for all road work authorized by the bill (which must be on the strategic network) but also for future expenditures of regular federal-aid funds when spent on the strategic network. How this will affect next year's highway expenditures is problematic, but in view of the rise in gas-tax income in many states it would appear that the states can take advantage of all the federal money that will be made available to them for work on the defense system, and will still have money to spend on roads that are not part of that network. Certainly, the high rate of federal aid will concentrate an unusual amount of work on the defense network, which is the objective sought by Congress.

Blue Ribbon for Drydocks

IT WAS TO BE EXPECTED that a construction program of the magnitude required to make our defense effort effective would produce important advances in structure design and construction technique. Many of these advances have now been recorded, and if comparisons were to be made it could hardly be denied that to date they are most strikingly apparent in the field of drydocks. Not only are drydocks being built in one-third the time that was formerly required, they are introducing practices that give promise of utility on other types of structures. In this issue is described the elaborate belt conveyor layout used to distribute the concrete for the San Diego drydock; a previous article outlined the procedure for drying up the site by a large wellpoint installation, which eliminated the need for a cofferdam. At Philadelphia and Norfolk, the entire drydock structure is being built under water with tremie concrete, pumped from mixer to placing barge through pipelines. At Newport News, the drydock is merely a cofferdam of the circular, earthfilled sheetpile cell type, equipped with a concrete bottom. At Los Angeles, the site was dried up by deep well pumps that lowered the groundwater level; and the concrete is being placed by cableway. In every case the drydock is being constructed with efficiency and speed, a fact that reflects great credit on the Bureau of Yards and Docks for sensing that there is no single best way to build such a structure. The consulting engineers, contractors and equipment manufacturers, individually or cooperatively, have made the procedures work in a way that permits an important new page to be written in the history of civil engineering achievement. Among defense structures drydocks deserve a blue ribbon.

Interest in New Tools

THE MOST EFFICIENT TOOL for any construction job is one that the personnel likes and wants to make work. Cantilever forms are a case in point. Following extensive use on the Panama Canal and the Miami Conservancy project many years ago, cantilever forms fell into disfavor, and thereafter found application on only a few medium-sized projects until very recently when they were adopted for several large dams, Mahoning, Shasta and Friant among them. At one of these dams the cantilever form and another type were used in comparison tests, and the cantilever found much more to the liking of the crews using it. But the form that it replaced had been just as enthusiastically received only two years earlier, and made an enviable record of safety and economy. Forms and other tools will always be made in a variety of types to suit the particular ideas of those responsible for their use. And it is probable that this continual change is always for the best, since it is as a result of new developments and new ideas that costs are reduced on engineering structures.

The Result of Diversion

VOTERS IN NEW YORK STATE, at the November elections, approved the use of $60,000,000 to be obtained from the sale of bonds, originally authorized for grade crossing elimination, to expand the state's parkway system and to speed up improvement of its main highway system. Although all dangerous crossings have not been eliminated (six persons were killed at a Long Island crossing last week), state officials are said to believe that the remaining crossing work is less important than roadbuilding. Drawing on funds authorized for crossing elimination offered a way for expediting this work. But, while the proposition put to the people was for a change in the earmarking of bonds already authorized, what they actually were asked to do was to authorize temporary abandonment of a pay-as-you-go policy with respect to highways. Whether the people realized what they were doing need not be argued here, nor is there the need to argue the pros and cons of pay-as-you-go versus bond financing. What should be pointed out, however, is that no such juggling would have been necessary were the state not diverting a large part of the taxes paid by motor vehicle users to other than highway purposes. Had the millions so diverted over the past decade been used for highways, New York would not now be having to sell bonds to get caught up on its roadbuilding program.

Time to Save

ENGINEERS, generally, are facing the scarcity of important construction materials realistically. Arthur Brewer's article in the Nov. 6 issue on designing to save steel emphasized one type of realistic thinking. Another type is represented by Elwyn E. Seelye's article in this issue, which is directed toward better and more efficient designing of brickwork. A third type is exemplified by the new USHA practice to substitute wood for metal, paint for galvanizing and plain for reinforced concrete. But whether it is to use less of a critical material or to use an available material more effectively, the necessary objective is to conserve the critical materials. Every possibility that can contribute to this end needs to be explored.

Designing comes first in the list of possibilities. Frills and non-essential details can be eliminated. Simplification and standardization are always savers of materials. Substitutes, coupled, of course, with redesign, can be used in many instances. Fuller use of local products and materials is another possibility; it will not only relieve the demand for critical items, but will also ease the transportation burden, already becoming acute.

The user, too, can save on materials, and here the contractor enters the picture. He has never been frugal with the tools and materials of construction—witness the junk piles of scrap lumber, bent pipe, discarded rope and cable and dozens of other items accumulated on every job. Construction equipment and tools can be made to last longer. Proper maintenance, inspection, lubrication and operation of machines will keep them rolling for a long time to come.

This country has the production capacity to serve all needs, not only those of construction. Yet, until the present scramble for commodities is straightened out, designers and contractors will be realistic if they quickly accept the challenge to conserve the critical materials.

Opportunity Knocks Again

PUBLIC WORKS CONSTRUCTION is destined to play an important role in the eventual transition from war to peace economy. Consequently no one will argue the desirability of having a planned program of public works, and everyone should applaud the steps already taken by the Public Work Reserve to establish procedures for the creation of a "shelf" of projects. But how well-prepared the nation will be to undertake public works construction when the occasion for it arises depends on the action taken now by the local and state governments in supporting long-range programming.

Unfortunately, some municipal administrators already have shown discouragement because the PWR efforts at present call merely for a listing of needed projects. This inventory, it should be explained, is the logical initial step, to be followed later by selection of projects for which preliminary plans and specifications can be drawn. And a bill now in Congress would provide substantial funds to implement local planning activities.

Even more sinister is the apathy displayed in communities where political opportunism rules. Politicians and party-machine administrators recognize that a well-ordered, long-range plan of commitments—based on an appraisal of public needs coupled with budget limitations—is contrary to their ideas of political strategy. They are not much interested in planned public works unless the objective is individual or party gain. Such communities have a housecleaning job to do before they can do much effective public works planning.

But the vast majority of communities have good reason to seize the opportunity created by the Public Work Reserve. In so doing they not only will contribute to their own future well-being, but will aid as well in shaping the national post-war economy along sound and healthy lines.

ENGINEERING NEWS-RECORD

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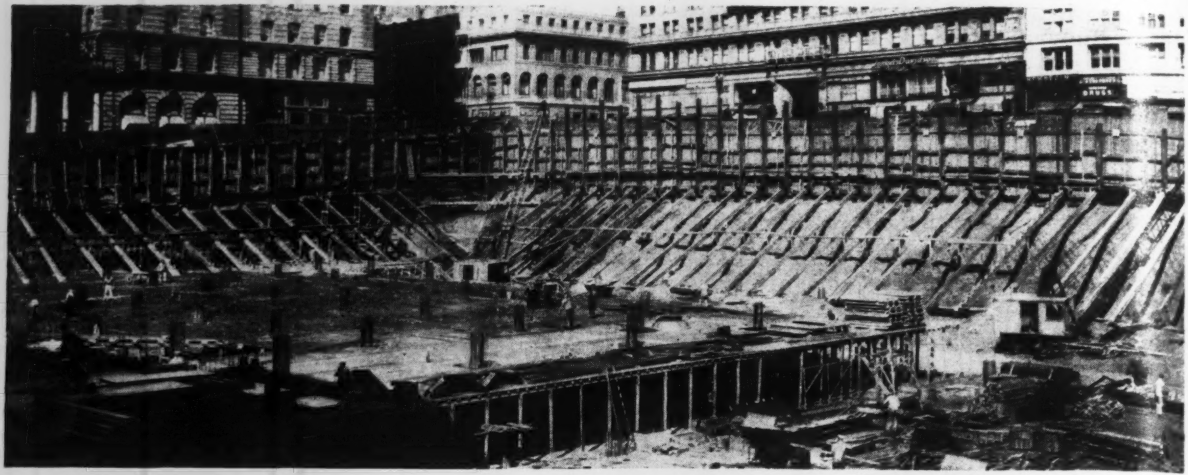


Fig. 1. The open excavation, 48 ft. deep, with tall buildings all around, necessitated care in bulkheading and bracing.

Four-Story Underground Parking Space

***Contents in Brief**—Union Square in downtown San Francisco, an area of 275x412 ft., has been excavated 48 ft. below street level for a concrete structure that will park 1,700 cars. Bulkheading problems, structural frame design and plans for carrying a heavy central monument in the park above called for special analysis.*

The Parking Problem in San Francisco's downtown shopping district became so serious that an organization was established, fostered by the city and subscribed to by interested merchants, for developing underground parking beneath Union Square. This square, occupying an area of 275x412 ft. in the congested area, offered unused underground space already owned by the city. By making an excavation 48 ft. deep for a structure extending four stories underground, it was found possible to provide parking space for 1,700 automobiles.

Accordingly, the Union Square Garage Corporation, a non-profit organization, was formed, sponsored chiefly by interested merchants, through which an $850,000 RFC loan was negotiated after local subscriptions of $600,000 had been pledged. The Park Commission approved the project on the assurance that after the structure below ground is finised, the surface will be landscaped better than before. When loans and subscriptions have been retired by income from operation, the improvements become municipal property. Meantime the corporation is to pay the city an annual rental of $5,000 and, at the present rate, about $13,000 per year in taxes. The work started Mar. 7, 1941; completion is expected about June 1, 1942.

Excavation was relatively simple because power shovels could load into dump trucks, which moved out on earth ramps. Unusual problems had to be worked out in bulkheading the sides of the excavation, chiefly in sand, which has a heavy surcharge on all four sides. The design of the structure itself also presents interesting problems, and a sentimental demand for the preservation of the Dewey monument that stood in the center of the park made it necessary to use earthquake-resistant design.

The bulkheading program provided for putting down steel piles around the periphery of the excavation and supporting them with inclined timber braces leading down to the bottom of the excavation. These braces thrust against the concrete footings for the second row of columns back from the exterior walls of the building.

The steel piles are spaced on centers about 9 ft. apart along two of the sides (Powell and Stockton Sts.) and about 8 ft. on the other sides (Post and Geary Sts.); distances were made such as to give a uniform spacing on all sides. Steel beam sizes for these piles range from 10-in. 53-lb. H sections to 21-in. 59-lb. WF beams, depending upon the steel stock that was locally available. The length ranges up to 54 ft. as a maximum. Incidentally, as this steel can be salvaged after completion of the building, it constitutes not only an excellent investment but has become a valuable asset in the light of priority restrictions imposed since the work began.

Wales between the steel piles consist of sets of timbers whose size and spacing vary with depth. At the bottom 8x10-in. wales are used on 3-ft. 9-in. centers. The bottom wales are placed against the inside flanges of the steel piles. In the upper lifts, wales bear against the outer flange of the steel piles, thus allowing the depth of the steel beam for offsets. Sheeting, driven vertically behind the wales with a small air hammer, consists of 2x6-in. planks mostly 20 ft. long with the lower edge mitered to facilitate driving.

Braces to support the steel piles of the bulkheading system, put in by trenching down ahead of full excavation, consist of 12x12-in. timbers. These braces are in pairs, the upper one resting against the pile not far below the top and the lower timber going in at as low a level as practicable. Single-stick timbers up to 60 ft. long were used. Diagonal bracing between the two timbers gave stiffness and to take care of the vertical component of the thrust on braces along one side (Powell St.) where water-bearing strata were encountered, a 12x12 was run across the tops of the upper braces and 1½-in. steel tierods were passed through this beam extending down to anchorages in the first row concrete column footings. These diagonal braces are all spaced so that they extend into the space to be occupied by the concrete structure *in between* the rows of columns, thus giving a minimum interference with construction of the building supports.

The bulkheading is set 3 ft. outside the building walls to allow space for placing wall forms, putting a waterproof coating on the outer face of the concrete and, finally removing of the bulkhead structure.

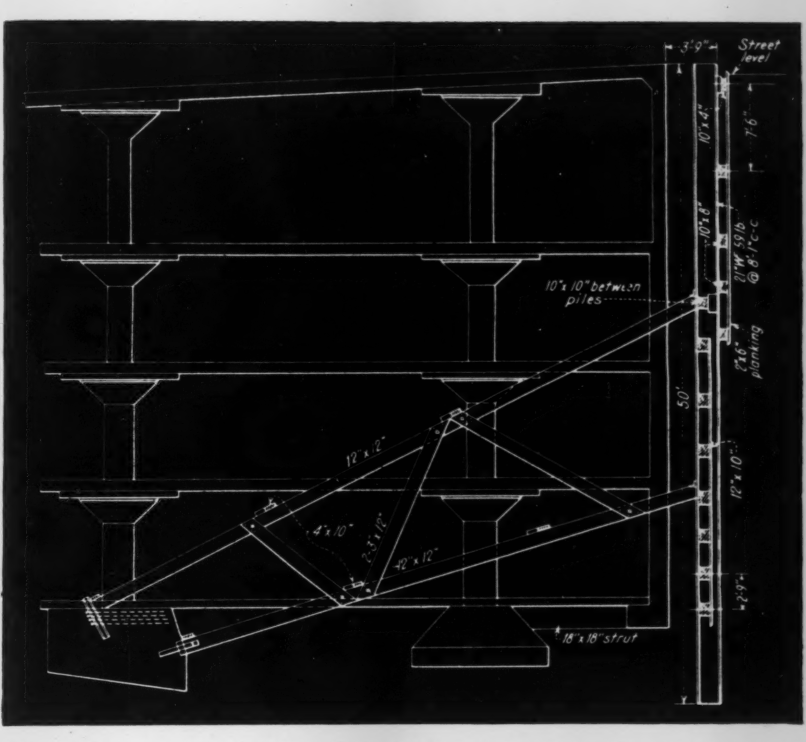


Fig. 2. Timber braces for the steel piles carry thrust to the second row of concrete column footings. Steel tierods resist vertical component of thrust.

The structure of the garage itself is designed to withstand thrust on all four sides, using the floors as horizontal diaphragms to transmit from one sidewall to the other. The floors are flat slab construction in bays 24 ft. 3 in. by 27 ft. 5 in. (which allows for three lines of parked cars) between rows of columns. At the bottoms of the walls, horizontal struts 18 in. square and on the same spacing as the columns, extend from the wall to the first row of column footings, thus providing additional resistance to side thrust. These struts have dowels bonding them into the floor slab which was poured later. The struts had to go in first because backfill was required around them up to the level of the under side of the floor slab.

The warped roof surface plus the desire to have short ramps with flat curves, resulted in a novel arrangement of floor levels. The main floor level, for each story, obtains only in the center of the building; on either side are mezzanine or half-floor levels. This arrangement also gives maximum space economy with the available headroom (9½ ft. floor-level to floor-level).

To enable the floors, which are flat slabs 10 in. thick, to function as horizontal diaphragms in transmitting thrust from one side of the excavation to the other, it is necessary to provide for this load to pass from mezzanine to main floor levels and back again on the opposite side. Ramps into the mezzanine floor are designed to carry these loads down to the floor below. At the center of the building, where there are no ramps, this transfer of load is accomplished by vertical panels, 14 in. thick, which serve as vertical shear walls to transmit stress from one level to another. These vertical panels are used between all offset floors where thrust is to be transmitted. In the floor slabs themselves, wherever thrust is parallel to construction joints, offsets are provided to transmit shear.

There is a maximum difference of 24 ft. in adjoining street levels; the Post-Powell intersection is that much

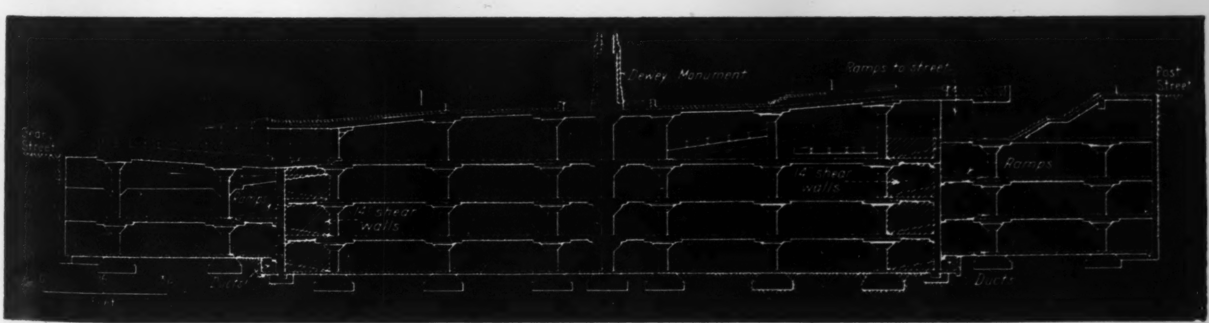


Fig. 3. Cross-section to show relation of mezzanine floors to main floors, ramps and shear walls.

above the level at Geary-Stockton. The finished surface of the square will be warped, therefore, to permit of street-level access on all four sides and to provide for a spacious rectangular plaza, on level ground in the center around the monument.

When concrete was being poured in the lower levels, some inconvenience and interference around the edges was inevitable as the result of the timber braces that project into the building area. As far as possible, reinforcing bars were spread around the timbers but in a few cases where this would have involved too great a displacement of the steel, holes were bored in the timbers and the reinforcing was thrust through. Additional bars were put in the slab adjacent to the timbers and loads were thus transferred as around openings. Later patching of the floor will be necessary after the timbers have been sawed out.

Where floors and walls are poured around the 12x12-in. timbers, concrete is kept away from the wood by a facing of ¾-in. fiberboard placed entirely around the timber. This protects the concrete against cracking that might result from swelling timber and will facilitate later breaking out of the timber.

The Dewey monument, a tall granite shaft that has long stood in the center of the square, is to be replaced atop the garage structure, somewhat reduced in weight and strengthened against seismic disturbance (which might easily have toppled it over before). As set up on its new supports, the central column of the monument will be hollowed out and will have a reinforced-concrete core bonding its several parts into a monolithic structure well anchored to its support. The roof panel on which this monument will stand (a 33-ft. 9-in. by 37-ft. slab) is to be thickened from the usual 12 in. to a 19-in. depth to resist horizontal loads of seismic origin. The supporting column beneath, running through to the foundation, will be 3 ft. in diameter all the way down. Typical building columns are 22 in. in diameter in the top story and 30 in. in the lowest story.

Concrete for the columns is specified as 1:4½ (3000 lb. minimum in 28 days). All other concrete may be either 1 to 5¾ with one inch maximum aggregate or 1 to 6½ with one and one-half inch maximum aggregate, both of which are to develop a minimum strength of 2,200 lb. in 28 days. The contractor is allowed to select between these two mixes provided that if the coarser aggregate is used, an additional ¼ in. in slab thickness is allowed to insure steel coverage.

Minimum height clearance in ramps is about 8 ft. and maximum grade 15 percent. All floor slab openings were framed without the use of beams. Continuous drop panels were used where loads are heaviest.

Walls are designed as 14-in. slabs between roof and top floor and as 16-in. slabs below the top floor. Pour-joints in all exterior walls are specially keyed to transmit earth pressures to the floor system. Stairways, at four locations, are completely enclosed in concrete fire walls with double-door or "air lock" access from the four floors. Stairs and vestibules are vented to sidewalk to avoid the smoke danger.

In the event of an air raid on downtown San Francisco the garage as now designed, including replacement of the park, will afford ample protection against incendiary bombs and building fragments. Information from cities recently subjected to bombing indicates that a large percentage of casualties is due to flying fragments of buildings which have been struck by bombs. Military authorities report that the heaviest types of bombs are seldom used to destroy non-military objectives, such as the business district of a city.

The roof surface is to be warped roughly to suit the contour of the original park at street level. The roof slab is to be 12 in. thick and will be overlaid by a minimum 2 ft. of topsoil for the landscaping. Tree boxes are designed to afford a 5-ft. soil depth.

Timothy L. Pflueger is the architect of the project. Walter L. Huber and Edward M. Knapik are the structural engineers. The contract for construction is held by MacDonald & Kahn, Inc., for whom L. H. Nishkian has designed the bulkheading.

Cities Acquire New Airport Control Privileges

Reflecting preparations of the defense program, new aviation laws in more than a dozen states this year give municipalities the right to acquire, improve and operate airports in their vicinity, and to control the approaches to them, according to a recent report of the American Municipal Association.

In noting the new acts, the association pointed out that the 1941 Congressional appropriation of $94,000,000 to build new, and improve landing areas at selected airports will be used in part for municipal airfields. The local governments, however, will be required to provide suitable publicly owned land, to construct the necessary buildings, and to maintain and operate the airports. More than 1,000 municipal airports now are on the approved list of the Civil Aeronautics Authority.

This year at least three states—Arizona, Maine and New Jersey—authorized their cities to acquire property for airports, and in Maine, operation of airports was made a governmental function, immune from tort liability. Maine also authorized cities and towns to go outside their limits in acquiring property for airports. Six other states—California, Idaho, Kansas, Oregon, South Dakota and Washington—provided that cities or cities and counties that do not find it practical to support airports individually may cooperate in owning and operating them.

Airport zoning, provided for previously in about a dozen state laws to keep approaches to airports free from hazards, was authorized this year in Arkansas, Maine, North Carolina, Oklahoma, Oregon and Wisconsin. The purpose of the zoning legislation, except in Oregon, was to permit cities to enact, administer and enforce zoning regulations for a specified distance around their airports—usually three to five miles. Oregon authorized its state board of aeronautics to establish safety zones around airports according to the procedure recommended by the Civil Aeronautics Authority.

Open Steel Caissons for Cast-in-Place Piles

Geo. B. Sowers
Consulting Engineer, Cleveland, Ohio

In a Unique Foundation for a large grain elevator at Buffalo, N. Y., three old-and-tried deep-foundation methods were successfully combined in construction of 193 cast-in-place piles, of 36-in. diameter and averaging 52 ft. long. Open caisson methods were used to form the holes through a top layer of soft clay, 6 ft. of hardpan at a depth of about 15 ft. and soft clay the rest of the way to rock; well-drilling methods, utilizing a churn type drill, were used to level and clean off the rock; and finally cast-in-place concrete pile-forming methods were used to build the concrete shafts.

Spiral-welded steel pipe casing was driven to rock by three steam hammer rigs operating in wide leads. Working three shifts a day, they constructed the 193 caisson shafts in 60 days. Best operation was eight complete foundation units in a 21-hr. period.

A 15-part line is reeved over the hammer to pull the 36-in. casing. Note suction baler in foreground.

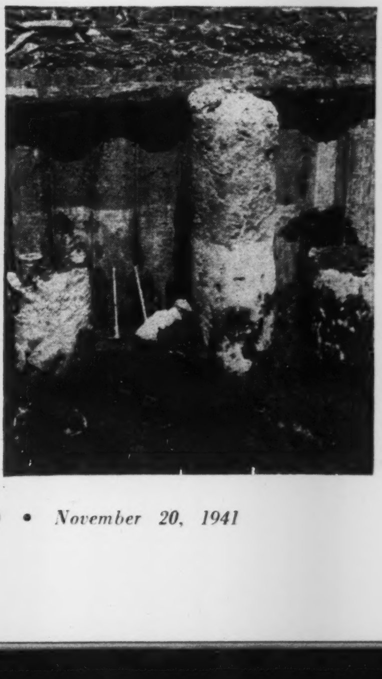
As driving proceeded, material was removed by use of a special suction baler in which a piston, being quickly pulled up, drew the clay into a cylinder for lifting to the surface. The driving rig was obliged to stand by for subsequent pulling so the hoist was utilized for baling and other power requirements.

When the rock surface was reached broken and soft strata were removed by a special star type churn drill and the surface cleaned by continued addition of clean water and removal by the baler. Full inspection was afforded by lowering a man into the pile shell.

With driving and clean-out complete, the steel casing was filled to the surface with concrete delivered by truck from commercial sources. As a final operation, the steel shell was withdrawn leaving a column of plain concrete to the rock surface. Withdrawal was accomplished by a 15-part line through special cable connections to a cap attached by a pin to the top of the casing. Only one steel casing was used for each driving rig.

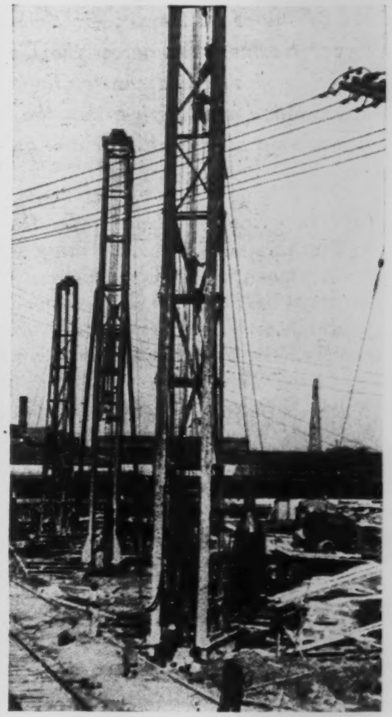
The maximum design load on the top of any one caisson shaft is 774,000 lb., with a minimum of 530,000 lb. A unit stress of 750 psi. on 4,000-lb. concrete was allowed by the building department of the city of Buffalo. Louis A. Harding is commissioner of buildings.

Piles were cast to above final top elevation and then were cut down to the designated final grade.



The new elevator, designed by the A. E. Baxter Engineering Co., of Buffalo, will consist of 36 grain bins 100 ft. high, resting on annular reinforced concrete beams, 36 in. deep supported by the caisson shafts. The elevator is an addition to the plant of the Cooperative G.L.F. Holding Corp. on the Buffalo River.

The James Stewart Corp. of New York and Chicago is the general contractor. The caissons were built by the Western Concrete Pile Corp. of New York, for whom the author is consultant, using methods designed and patented by J. H. Thornley, president, Western Foundation Co.



Special, heavy rigs drive 36-in. shells, clean-out for cast-in-place concrete piles and then pull the shells.

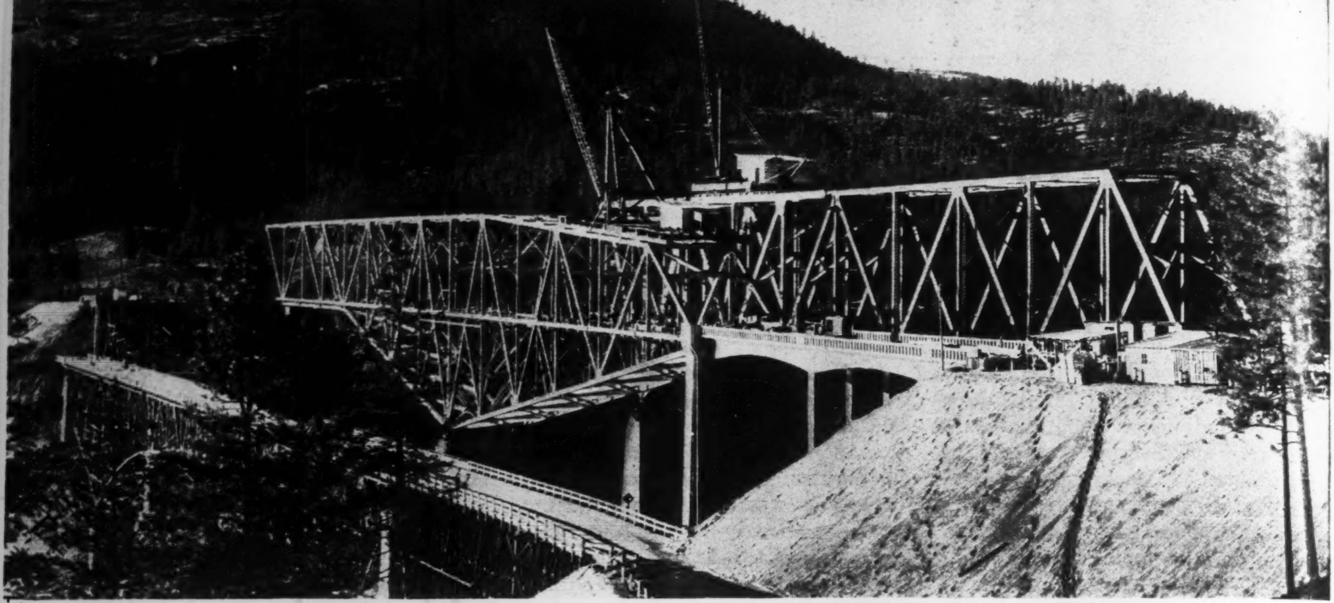


Fig. 1. New railroad bridge at right and new highway crossing in center with old highway span at lower level.

An Unusual Railway Cantilever Bridge

J. A. Wineland
Associate Engineer, U. S. Bureau of Reclamation
Denver, Colo.

Contents in Brief*—First described are the various studies carried out by the Bureau of Reclamation to determine the best type of bridge to carry the Great Northern Ry. across the Columbia River in Washington. This is followed by design and construction details for the cantilever bridge decided upon, which is unusual in that the center span is fixed while each end span is made up of a cantilever arm and a suspended span.*

CONSTRUCTION OF Grand Coulee Dam in Washington, with its resulting reservoir, made necessary the relocation of State Highway No. 3 and the Republic branch line of the Great Northern Ry. where they cross the Columbia River. The existing crossings, the railway bridge at the town of Marcus and a few miles downstream, the highway bridge at the rapids known as Kettle Falls, were made unsuitable for use with the higher water elevations of the Grand Coulee reservoir. Investigations for new crossings at higher elevations showed the most suitable site to be at the existing Kettle Falls Bridge.

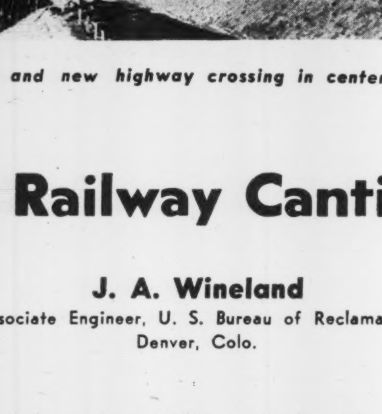


Fig. 2. Abutment 1 complete except for concrete surface finishing, which is in progress. The greater part of the abutment will be embedded in an earth-fill.

To raise the existing highway bridge, which was a deck structure with the truss depth at the piers 90 ft., sufficiently to clear the reservoir water surface would have placed the roadway 40 ft. higher than a new crossing. The longer and higher approach spans and embankments thus required, as well as facilities for maintaining traffic during construction, made uneconomical the raising of the old highway bridge. Therefore, the problem resolved itself into providing a new crossing for both highway and railway traffic.

Problems of joint ownership

When studies were made by the Bureau of Reclamation to determine whether a combined structure or separate crossings would be best, factors considered were: (1) economy; (2) completion of the work within a relatively short time, so as to avoid delays in construction of Grand Coulee Dam; (3) possible negotiation of a contract between the State of Washington and the Great Northern covering future ownership and maintenance for a combined bridge; and (4) objections of the Washington State Highway Department to a combined highway and railroad bridge.

Although the studies showed a combined crossing to be more economical than two separate structures, it was decided that a railroad bridge should be built by the Bureau of Reclamation and a separate highway span by the state highway department. In this way the difficulty of negotiating a joint contract of ownership was avoided, and the construction program was greatly expedited. The new railway cantilever bridge is unusual and its design and construction will be described in detail in the following paragraphs.

During the spring flood stage the river at Kettle Falls is a fast-flowing stream approximately 425 ft. wide and 100 ft. deep. Granite banks rise steeply to about 40 ft. above the water surface and provide an excellent pier foundation. It is anticipated that future navigation will require a vertical clearance of 45.5 ft. between the reservoir water surface and the lowest steel of the central span. Likewise an allowance of 8 ft. for the railroad floor system was made in determining the lowest possible elevation of the track.

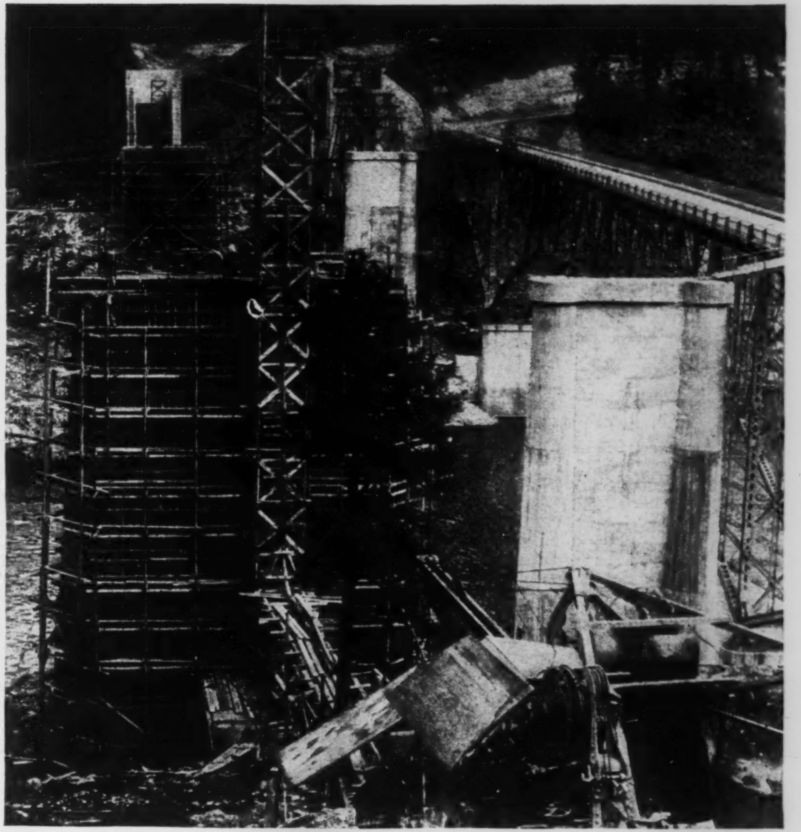


Fig. 3. Old Kettle Falls highway bridge, which will be abandoned, is shown at right. Completed piers and abutments for the new highway crossing are in the center, while at left construction is in progress on railroad bridge piers.

Determining central span length

As the length of the span crossing the stream would have a major influence on the structure's total cost, the length of this span was, therefore, held to a minimum. After a careful study of the profile, topography, and geology, the piers were located as near the stream bank as was deemed advisable or the length of the span crossing the river established at approximately 600 ft.

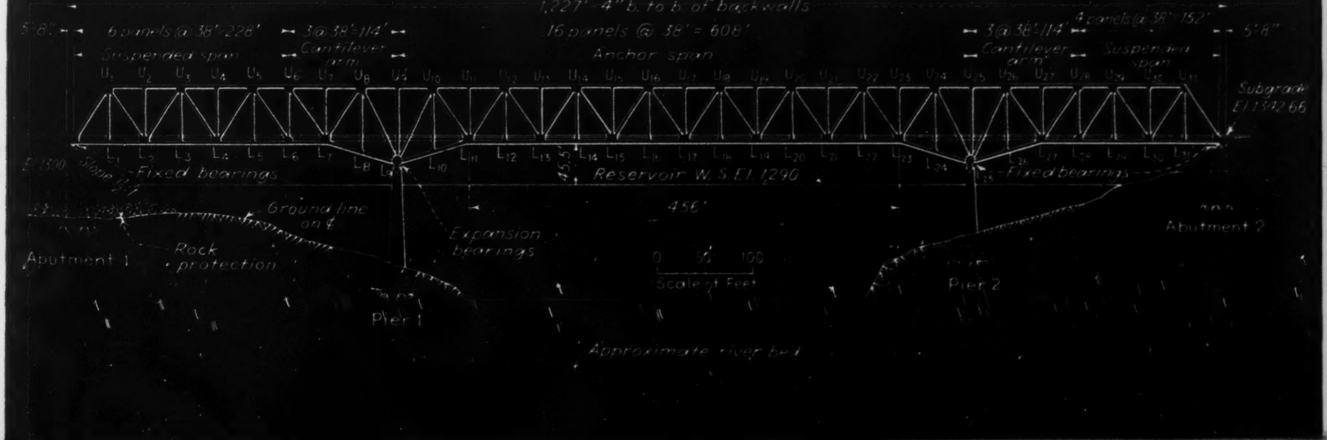
The bridge's height above the river bed and the stream's depth and velocity made the use of erection falsework impracticable. Since a cantilever bridge, more than any other type, can generally be readily and economically erected without the use of falsework, this type of structure was chosen.

After the type of structure and center-span length were determined, various economic studies were made in which the length of the side or anchor spans were varied. First, anchor spans of medium length, to extend from the piers to the approach embankment were investigated, but it was found that for such spans under passage of live load a reversal of stress would occur at the end bearings. As past experiences with railroad bridge bearings under similar conditions have not been satisfactory, anchor spans of medium length were considered undesirable. (On the highway bridge, reversal of stress at the end bearings of medium-length anchor spans did not occur and the conventional type cantilever structure appeared suitable.)

Unusual cantilever selected

As part of the railway bridge studies, side spans where reversal of stress would not occur were considered and short spans were found to cost considerably less than long spans, as the approach embankment could be con-

Fig. 4. Unusual design for railroad bridge in which center span is fixed and suspended spans are at the ends.



1,227'-4" b. to b. of backwalls
5'-8"
6 panels @ 38'=228'
Suspended span
3@38'=114'
Cantilever arm
16 panels @ 38' = 608'
Anchor span
3@38'=114'
Cantilever arm
4 panels @ 38'=152'
Suspended span
5'-8"
U1 U2 U3 U4 U5 U6 U7 U8 U9 U10 U11 U12 U13 U14 U15 U16 U17 U18 U19 U20 U21 U22 U23 U24 U25 U26 U27 U28 U29 U30 U31
L1 L2 L3 L4 L5 L6 L7 L8 L9 L10 L11 L12 L13 L14 L15 L16 L17 L18 L19 L20 L21 L22 L23 L24 L25 L26 L27 L28 L29 L30 L31
Subgrade El.1342.66
El.1300
Slope 1½:1
Fixed bearings
45.5'
Reservoir W. S. El. 1290
Fixed bearings
Ground line on ℄
456'
Expansion bearings
Abutment 1
Rock protection
0 50 100
Scale of Feet
Abutment 2
Pier 1
Pier 2
Approximate river bed

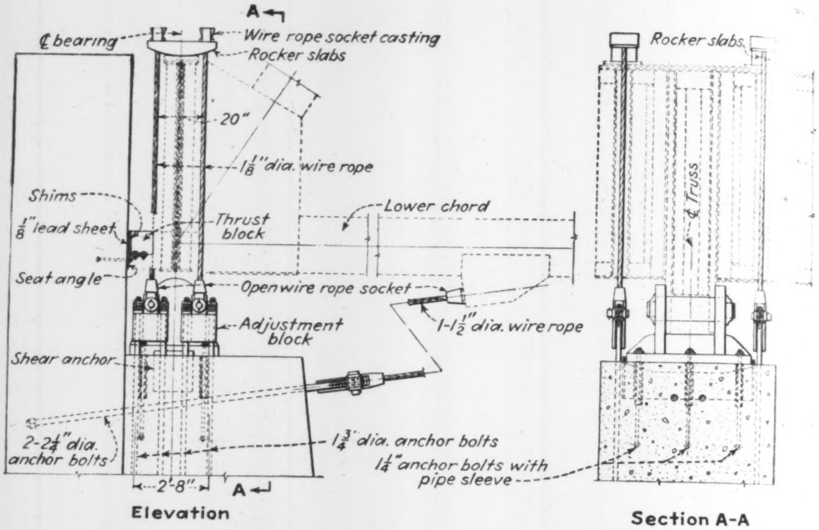

A
℄ bearing
Wire rope socket casting
Rocker slabs
20"
1 1/8" dia. wire rope
Shims
1/8" lead sheet
Thrust block
Lower chord
Seat angle
Open wire rope socket
Adjustment block
1-1 1/2" dia. wire rope
Shear anchor
2-2 1/4" dia. anchor bolts
1 3/4" dia. anchor bolts
1 1/4" anchor bolts with pipe sleeve
2'-8"
A
Elevation
Rocker slabs
℄ Truss
Section A-A

Fig. 5. Uplift during erection required anchors at Abutment 1. At Abutment 2 the thrust blocks, seat angles, and ties to the bottom chord are not required.

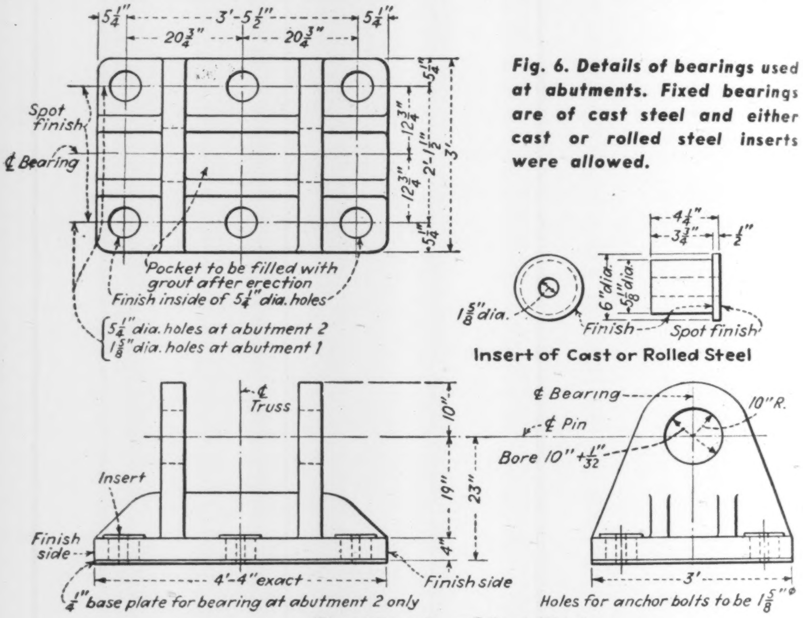

5 1/4"
3'-5 1/2"
5 1/4"
20 3/4"
20 3/4"
Spot finish
℄ Bearing
5 1/4"
12 3/4"
12 3/4"
2'-1 1/2"
3'
5 1/4"
Pocket to be filled with grout after erection
Finish inside of 5 1/4" dia. holes
5 1/4" dia. holes at abutment 2
1 5/8" dia. holes at abutment 1
4 1/4"
3 3/4"
1/2"
1 5/8" dia.
6" dia.
5 5/8" dia.
Finish
Spot finish
℄ Truss
10"
19"
23"
4"
Insert
Finish side
4'-4" exact
Finish side
1/4" base plate for bearing at abutment 2 only
℄ Bearing
℄ Pin
10" R.
Bore 10" + 1/32"
3'
Holes for anchor bolts to be 1 5/8" φ

Fig. 6. Details of bearings used at abutments. Fixed bearings are of cast steel and either cast or rolled steel inserts were allowed.

Insert of Cast or Rolled Steel

Fixed Bearing of Cast Steel

structed cheaply. However, the more economical short anchor spans required three girder approach spans between the anchor span and the end of the embankment to keep the embankment's toe at a safe distance from the steeper river banks. Such a structure, consisting of truss spans and girder spans, seemed to lack continuity of design and appearance; and it was felt that trusses, in place of girders, should be used throughout the side spans. Further studies revealed that by placing the suspended spans at the ends and making the river or main span the anchor span of the cantilever structure, trusses could be used for the side spans and stress reversal at the end bearings avoided. Thus, this rather unusual arrangement seemed to be the most desirable design from the standpoint of maintenance, economy and appearance.

The bridge decided upon (Fig. 4) has a 608-ft. center span, a 114-ft. cantilever arm extending landward from each of the two main piers and then ends with a 152-ft. suspended span at the west end and a 228-ft. suspended span at the east end. Trusses are 30 ft. center to center and a 22-ft. minimum clearance between top of rail and lowest steel of the portal and sway bracing was required.

In preparing the design it was realized that the method of erection would be a determining factor for a number of the truss members. If erection stresses were not considered in the design at the start they would involve changes in design and details at a later date, and would consequently cause delays in fabrication and construction. Therefore, erection stresses were calculated, and proper allowance was made for these throughout the bridge as the design advanced. This procedure proved to be very satisfactory, as the contractor's method of erection required only minor changes in details for the jacking devices.

Erection procedure

The erection procedure was essentially as follows: Steel in the two side spans was supported by falsework until the bearings at Piers 1 and 2 (Fig. 4) were placed. This falsework was then removed and steel in the center span cantilevered from each pier until closure at the center was complete. After closing the main span, jacks in the idle members U_5–U_6, L_6–L_7, U_{28}–U_{29}, and L_{27}–L_{28} were removed and the structure attained its final position.

At Abutment 2, the bearings remained fixed until the fixed bearings at Pier 2 had been placed, after which the bearings on the abutments functioned as expansion bearings. This was accomplished by removing the steel inserts that fitted into the oversized anchor bolt holes of the abutment bearing (Fig. 6), thus permitting longitudinal movements due to temperature changes and jacking operations during the center span's erection. Steel plates were embedded in the abutment along the sides of the bearings to take any lateral thrust without preventing longitudinal movement.

During the latter stages of erection it was necessary to restrain the bearings at each abutment against uplift by using wire rope ties between the end floorbeam and the abutment (Fig. 5). The length of these ties at Abutment 2 was adjusted so that the bottom of the bearings would raise a small distance off the abutment and eliminate any frictional resistance against longitudinal movements. A rocker and plate bearing on the end floorbeam's top flange transferred the uplift of the truss to the wire rope ties, which were connected at their lower ends through adjustment blocks to special anchor bolts in the abutment. Wire rope ties were used because they are sufficiently flexible to permit longitudinal movement without undue overstress. After the center span had been closed, the suspended span was moved until the steel inserts could again be put in place and the bearings at Abutment 2 were fixed in their final positions.

At Abutment 1 the bearings remained fixed throughout the entire erection procedure. This was made possible by the use of the expansion bearings at Pier 1, and steel inserts, as used on Abutment 2, were unnecessary. Further, the bearings were fixed against longitudinal movement by using a thrust block between the back wall of the abutment and the end of the truss, and by a wire rope tie from the abutment to the bottom chord.

The piers and abutments were constructed by A. A. Prendergast & Associates and Industrial Contracting Co., Minneapolis, Minn. The steel was fabricated and erected by the American Bridge Co. The plans and designs were prepared in the Denver office of the Bureau of Reclamation under the direction of R. Sailer, bridge engineer, and the supervision of H. R. McBirney, principal senior engineer of canals, and J. L. Savage, chief designing engineer. Construction of the bridge was supervised by Field Engineer A. J. Thomas under the direction of F. A. Banks, supervising engineer, Columbia Basin Project. All activities for the Bureau are under the direction of S. O. Harper, chief engineer, and John C. Page, commissioner.

Moving a 200-ton Dredge Overland To the New Panama Canal Lock Site

PICKED UP BODILY and placed on shore, then skidded 1,800 ft. overland into an artificial pool, to begin excavating for the additional locks for the Panama Canal, the 22-in. hydraulic dredge *Grand Lake* recently completed a long trip begun weeks ago near Kansas City, Mo.

Towed to New Orleans, the dredge was stripped of its machinery and provided with a superstructure for its ocean trip to the Canal Zone. Upon arrival at the Isthmus, the dredge was moored along the canal bank while the superstructure was removed. Then the 100x35-ft. hull, weighing 220 tons, was picked up by the floating crane *Ajax* and placed on a skidway. Sliding on two timber ways, the dredge was slowly moved overland, crossing a highway and three railroad tracks (see illustration), including the main line of the Panama Railroad. Motive power was supplied by a tractor, using cables and blocks.

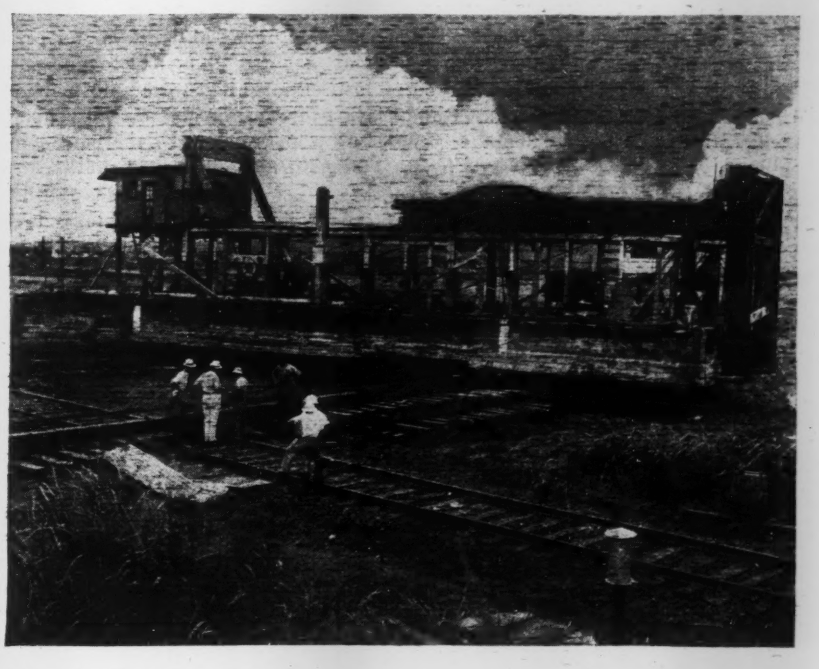
About Sept. 1, the dredge was floated into the pool and its machinery re-installed, for the removal of about 2,000,000 cu.yd. of material at the north end of the new Gatun Locks site. As the pool is not yet connected with a waterway, water is being supplied from the canal through a 2,000-ft., 22-in. pipe, fed by two 16-in. pumps, each driven by a 250-hp. motor. To permit dredging to the required 65-ft. depth, the pool surface will gradually be lowered as excavation progresses. The final use of the dredge will be to unwater the pool, in order that hard material that underlies the muck may be excavated and the locks built in the dry.

The Sternberg Dredging Co. of St. Louis, Mo., owner of the *Grand Lake*, has subcontracted for the dredging from Martin Wunderlich Co. and Okes Construction Co., principal contractors for excavation of the new Gatun Locks site. Of the 12,000,000 cu. yd. of excavation required by the basic contract, approximately 2,400,000 yd. had been removed by Aug. 1.

To lift and transport the material to the spoil areas, which will be up to a maximum distance of about 10,000 ft. from the cut, the *Grand Lake's* 1,200-hp. pump will be supplemented by a 1,000-hp. fixed land booster pump. In order that 25-cycle Canal Zone power may be used by the 60-cycle dredge machinery, a frequency changer had to be installed.

Operations of the prime contractors are supervised by Martin Wunderlich and Day Okes. H. J. Sternberg personally supervised the moving of the *Grand Lake*, aided by Harry Gray and Roy F. Keller.

Col. T. B. Larkin, Corps of Engineers, is supervising engineer in charge of this project of the Panama Canal; Lt. Col. Hans Kramer is construction engineer; and E. B. Fontaine is area engineer in immediate charge of work in the Atlantic area.



On Ft. Bragg-Fayetteville highway, contractor supplies equipment and mixes concrete. WPA furnishes the labor.

Contractor and WPA Build Access Road

***Contents in Brief**—Improvement of the principal access road to Ft. Bragg has been completed under a competitive bid contract for equipment and supervision, with WPA furnishing materials and most of the labor. Paving was done with conventional machines and methods except use of a more-than-usual number of men.*

WPA HAS CONSTRUCTED about 9½ miles of dual 22-ft.-lane pavement for the principal access to Ft. Bragg from Fayetteville, N. C., nearby rail, business and housing center. Quartering 65,000 troops, mostly motorized, has created a serious traffic situation, which the new roads seeks to alleviate. For part of the distance from the camp to Fayetteville the existing 22-ft. concrete road, widened from an original 18 ft., serves as the lane in one direction. For about half of the distance, however, the entire road is on new location and in both sections a center mall 30 ft. wide is provided up to the Fayetteville city line, where it becomes a single four-lane 44-ft. wide highway. It is expected that motorized units of the army will use the mall for stopping, as required, to organize for maneuvers.

Construction has been done under a partial contract arrangement whereby a contractor, selected by competitive bidding supplied equipment, some operators and the supervision. The project sponsor, North Carolina State Highway and Public Works Commission, provided the right-of-way for the road, made all surveys and plans and handled the field engineering inspection as if it were a normal contract job. Equipment and most operators were supplied by the contractor. WPA furnished the material, most of the skilled and all of the unskilled labor. The contractor unloaded the aggregates, batched and hauled material and mixed and screeded the concrete.

Grading

Major cuts and fills were encountered on some of the road, a grade of 4.2 percent being used for one short stretch. Most of the earth handling was done with heavy machinery rented from owners on an hourly basis. Eight-yard tractor-drawn scrapers were rented at $8 per hr. with operator and fuel; smaller equipment rates were in proportion. An attempt was made at first to compact only with the dirt moving equipment but state inspectors found this so unsatisfactory that they refused approval of pavement construction over such areas until rolling was done. The contractor then furnished a sheepsfoot roller (for a time at no compensation) to pack the fill.

Contractor's direction

Paving was under the direction and general responsibility of the contractor. Fine grading was done by a patrol grader and by hand, following which standard road forms were set by WPA labor working at the direction of the contractor's foreman. At the batch plant the contractor supplied a portable bin with weigh batchers, cement warehouse, a 1-yd. crane and the crane operator with WPA supplying the labor. All material was received by rail, cement being delivered in paper bags in box cars; sand and gravel, in gondola cars, were unloaded by the crane and batched by gravity into 1½ to 3-ton trucks, hired and paid by the contractor and hauling two 1-yd. batches each. The requisite number of sacks of cement were thrown, unopened, on top of each batch as the truck stopped at the cement car or storage shed. Average length of haul to the paver was about five miles as the nearest desirable plant location was two miles from the road but centrally located.

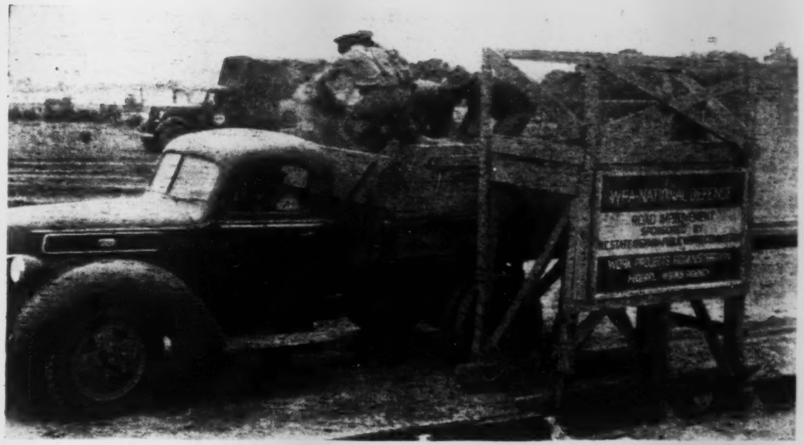
Just ahead of the paver two sections of road forms were removed to permit batch trucks to pull onto the subgrade. Here the cement sacks, previously thrown on top of the batches, were cut open and dumped on the aggregate from a skid-mounted platform, truck-body high, by four men, who stepped onto the load to open the bags. Bags were immediately burned in a wire enclosure.

Trucks then backed to the paver, operated on the subgrade in the center of a lane. The paver used was a 27-E single-drum operated by a contractor-paid employee, at an average of 40 batches per hour, and pulling a cutting templet, which shaped the subgrade to plan profile. Concrete was placed in one course for the entire 22-ft. width and 9-7-7-9-in. depth of the road (7-in. depth is uniform across the center 18 ft. with edges sloping to 9-in. depth at the curb). Only reinforcing members were short dowels used across the plane of weakness at the longitudinal center of the slab and at the contraction and expansion joints.

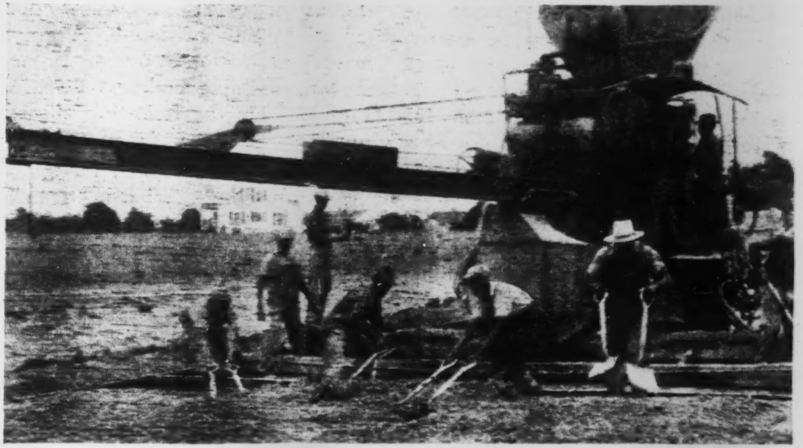
Some hand-spreading of the dumped batch was immediately followed by a power-driven transverse screed finisher, operated by one of the contractor's employees. Following this, a machine spanning the roadway width cut a plane of weakness along the longitudinal center line of the slab and inserted a $\frac{1}{16}$-in.-thick by 2-in. mastic filler mechanically.

Back of the center joint machine a longitudinal float, 10 ft. long and lapped halfway for each move ahead, was hand-operated from two wooden skid bridges. A concrete finisher working on each side of the slab checked the concrete for the limiting $\frac{1}{8}$-in.-in-10-ft. tolerance permitted, using an aluminum straightedge for a push-pull concrete working tool to remove irregularities. After the concrete attained its initial set so that the water sheen disappeared it was belted with a bow belt, rigged with plow handles for easy operation.

Wet burlap was laid over the slab as soon as the concrete hardened sufficiently to prevent marking; about 4 hours later, when the concrete attained its final set, the burlap was removed; the concrete was again straightedged and corrected where required; and finally the slab was wet down and covered with a sisal curing paper covering for 72 hours. Traffic was permitted after 14 days.



Skid-mounted platform at truck height is parking place for cement dumpers.



WPA employees, with two shovels apiece, spread concrete placed on subgrade by contractor. Finishing was carried out with usual methods.

WPA forces

In addition to the contractor's forces WPA had an oiler on the crane at the batching plant, 3 men cleaning aggregate cars, 6 men on cement and one at the batcher. At the paver 4 men opened the cement bags, 2 worked on longitudinal and transverse joints, 4 leveled the grade at the paver, 4 puddled the soft concrete, one was operator on the center joint machine, two operated the longitudinal float, about 6 worked on finishing, 4 handled burlap, and where there was integral curb 6 more men were used. Others prepared the grade, set forms and pulled and moved ahead the forms required.

WPA employees were paid 31c. per hour for most jobs, 37½c. for puddlers, and 48c. for finishers and machine operators. Men were hauled as much as 60 miles to work by WPA as there were no relief eligibles nearer.

F. D. Cline of Raleigh was the contractor and received 65½c. per sq. yd. of paving for the use of equipment, hauling material and supplying the operators and supervision. Incentive to the contractor for speed came in cutting down on the time his equipment and personnel were held on the work; incentive for economy of materials was supplied by the opportunity to haul and process less material where the subgrade was properly maintained and the surface closely screeded. H. J. Ziegler was superintendent for the contractor.

The North Carolina highway department, under state engineer W. Vance Baise, was represented by T. T. Betts, division engineer; L. C. Grede, resident engineer and S. S. Hurt, inspector. Henry G. Ragland was superintendent for the WPA.

Brickwork as Seen by the Engineer

Elwyn E. Seelye
Consulting Engineer, New York

***Contents in Brief**—Proportioning a brick wall is discussed as the problem of a structural engineer, whose methods should replace rule-of-thumb practice. Specific design questions include girder concentrations, wall stability, effect of buttresses, and pier dimensions. A new method of proportioning lintels and a "hybrid" steel-frame construction are described.*

When the Structural Engineer enters the field of brick masonry he should tread softly and reverently, for he is dealing with one of man's oldest construction mediums—a material that has sheltered man for thousands of years and has not been found wanting. Here is an almost indestructible material, with qualities of endurance, color and texture not possessed by any other artificial wall material. Nevertheless, like other materials brick masonry needs engineering to supplement craftsmanship if it is to be used to best effect.

Let us take the question of proportioning a brick wall, now done largely by rule of thumb. A graphical representation of one of the most modern building codes is given by Fig. 1. Note the following absurdities:

(a) A special rule is set up for private dwellings. What in the name of engineering sense has occupancy to do with proportioning a wall?

(b) Percentage of opening is used to regulate wall thicknesses. Yet the resistance of walls to buckling, crushing, lateral pressure or earthquake shock is only indirectly determined by percentage of openings.

(c) The curtain wall, which carries no load and is braced by columns or pilasters, increases in thickness in the lower story. Why? Its function is to span as a slab between columns or pilasters; as wind pressure is more intense in the upper stories, the law might logically require the wall to be thicker at the top than at the bottom.

(d) Note the proportions of the bearing wall marked "General Case." Why is an 8-in. wall permitted in the top story of one, two and three-story buildings, but not in higher buildings? Why are buildings less than 75 ft. high placed in a weaker "saving" classification? As a matter of fact, the latter includes the great mass of six-story, semi-fireproof apartments, involving more lives than in any other type of structure.

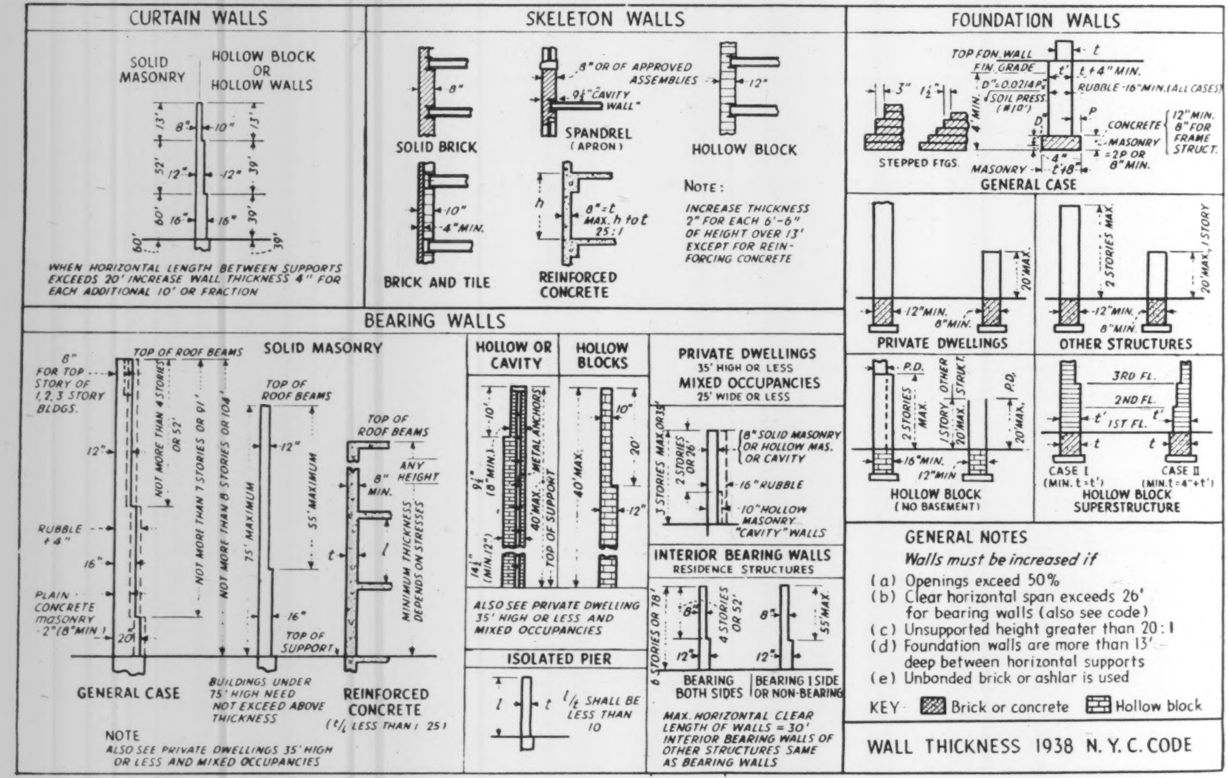

CURTAIN WALLS
SOLID MASONRY
HOLLOW BLOCK OR HOLLOW WALLS
13'
8"
10"
52'
12"
39'
60'
16"
WHEN HORIZONTAL LENGTH BETWEEN SUPPORTS EXCEEDS 20' INCREASE WALL THICKNESS 4" FOR EACH ADDITIONAL 10' OR FRACTION
SKELETON WALLS
8"
SOLID BRICK
8" OR OF APPROVED ASSEMBLIES
9½" "CAVITY WALL"
SPANDREL (APRON)
12"
HOLLOW BLOCK
10"
4" MIN.
BRICK AND TILE
h
8" = t
MAX. h to t 25:1
REINFORCED CONCRETE
NOTE:
INCREASE THICKNESS 2" FOR EACH 6'-6" OF HEIGHT OVER 13' EXCEPT FOR REINFORCING CONCRETE
FOUNDATION WALLS
TOP FDN. WALL
FIN. GRADE
t
t'
t + 4" MIN.
D" = 0.0214P × √SOIL PRESS. (#/□')
RUBBLE - 16" MIN. (ALL CASES)
4' MIN.
3"
1½"
STEPPED FTGS.
P
D"
CONCRETE
MASONRY
= 2P OR 8" MIN.
12" MIN. 8" FOR FRAME STRUCT.
4"
MASONRY
t + 8"
GENERAL CASE
20' MAX.
12" MIN.
8" MIN.
PRIVATE DWELLINGS
2 STORIES MAX.
20' MAX., 1 STORY
OTHER STRUCTURES
P.D.
2 STORIES MAX.
1 STORY 20' MAX.
OTHER STRUCT.
16" MIN.
12" MIN
HOLLOW BLOCK (NO BASEMENT)
3RD FL.
2ND FL.
1ST FL.
CASE I (MIN. t = t')
CASE II (MIN. t = 4" + t')
HOLLOW BLOCK SUPERSTRUCTURE
BEARING WALLS
SOLID MASONRY
8" FOR TOP STORY OF 1, 2, 3 STORY BLDGS.
TOP OF ROOF BEAMS
NOT MORE THAN 4 STORIES OR 52'
NOT MORE THAN 7 STORIES OR 91'
NOT MORE THAN 8 STORIES OR 104'
12"
RUBBLE + 4"
16"
PLAIN CONCRETE masonry - 2" (8" MIN.)
20"
GENERAL CASE
75' MAXIMUM
55' MAXIMUM
BUILDINGS UNDER 75' HIGH NEED NOT EXCEED ABOVE THICKNESS
TOP OF SUPPORT
ANY HEIGHT
8" MIN.
t
l
MINIMUM THICKNESS DEPENDS ON STRESSES
REINFORCED CONCRETE (t/l LESS THAN 1 : 25)
NOTE
ALSO SEE PRIVATE DWELLINGS 35' HIGH OR LESS AND MIXED OCCUPANCIES
HOLLOW OR CAVITY
10'
9½" (8" MIN.)
14½" (MIN. 12")
METAL ANCHORS
40' MAX.
TOP OF SUPPORT
HOLLOW BLOCKS
10"
20'
12"
ALSO SEE PRIVATE DWELLING 35' HIGH OR LESS AND MIXED OCCUPANCIES
ISOLATED PIER
l/t SHALL BE LESS THAN 10
PRIVATE DWELLINGS 35' HIGH OR LESS
MIXED OCCUPANCIES 25' WIDE OR LESS
3 STORIES MAX. OR 35'
2 STORIES OR 26'
8" SOLID MASONRY OR HOLLOW MAS. OR CAVITY
16" RUBBLE
10" HOLLOW MASONRY "CAVITY" WALLS
INTERIOR BEARING WALLS
RESIDENCE STRUCTURES
6 STORIES OR 78'
4 STORIES OR 52'
55' MAX.
BEARING BOTH SIDES
BEARING 1 SIDE OR NON-BEARING
MAX. HORIZONTAL CLEAR LENGTH OF WALLS = 30' INTERIOR BEARING WALLS OF OTHER STRUCTURES SAME AS BEARING WALLS
GENERAL NOTES
Walls must be increased if
(a) Openings exceed 50%
(b) Clear horizontal span exceeds 26' for bearing walls (also see code)
(c) Unsupported height greater than 20:1
(d) Foundation walls are more than 13' deep between horizontal supports
(e) Unbonded brick or ashlar is used
KEY ▨ Brick or concrete ▦ Hollow block
WALL THICKNESS 1938 N. Y. C. CODE

Fig. 1. Brickwork requirements of a modern building code represented graphically for different types of walls.

Such illogical rules have a tendency to lull the non-engineer into the comfortable belief that if he proportions walls in accordance with the code they will be safe. Nothing could be farther from the fact. The notorious Mosholu Parkway bearing-wall apartment, which collapsed with a large death list, was proportioned according to the code, but defective design permitted excessive load concentration to come on green masonry. Stability, crushing strength and resistance to buckling are of paramount importance in brick wall construction, and rule of thumb cannot make them adequate.

Typical design problems

A hypothetical wall will serve to illustrate typical problems that the structural designer is likely to meet.

Refer to Fig. 2. An unbalanced skewback is indicated at X; this requires a relieving beam. Points of high compressive stress are indicated at sections A-A to G-G and each of these requires special investigation. The lintel under Load G_2 should be studied for length of end bearing. Area Z has an unusual concentration of loading. If this is excessive the wall must be strengthened by a pier or column or the loading modified.

Note that piers F and G are weakened by chases and therefore should be investigated; that the foundation wall must be strong enough to resist earth pressure and may need a widened footing under piers F and G; and that at most of the points mentioned, the slenderness ratio of walls and piers should be scrutinized.

Stability and crushing strength

Stability often requires examination in wall design. Because brickwork is elastic but cannot be counted on to resist tensile stresses, the stability of a wall is defined by overturning resistance with due consideration of the crushing strength of the brickwork at the fulcrum edge of the failure joint.

Thus, in Fig. 3 the wall is stable if the resisting moment of the weight of the wall is greater than the overturning moment, and if the pressure of the fulcrum does not exceed the working strength of the brick masonry. The overturning moment is PL and the resisting moment is $W(t/2 - x/3)$. The extreme fiber stress is $S = \frac{W}{x/2}$. To proportion the wall thickness, first determine the bearing width x from the permissible bearing pressure S, and thus locate the resultant R, which enables the overturning resistance to be checked.

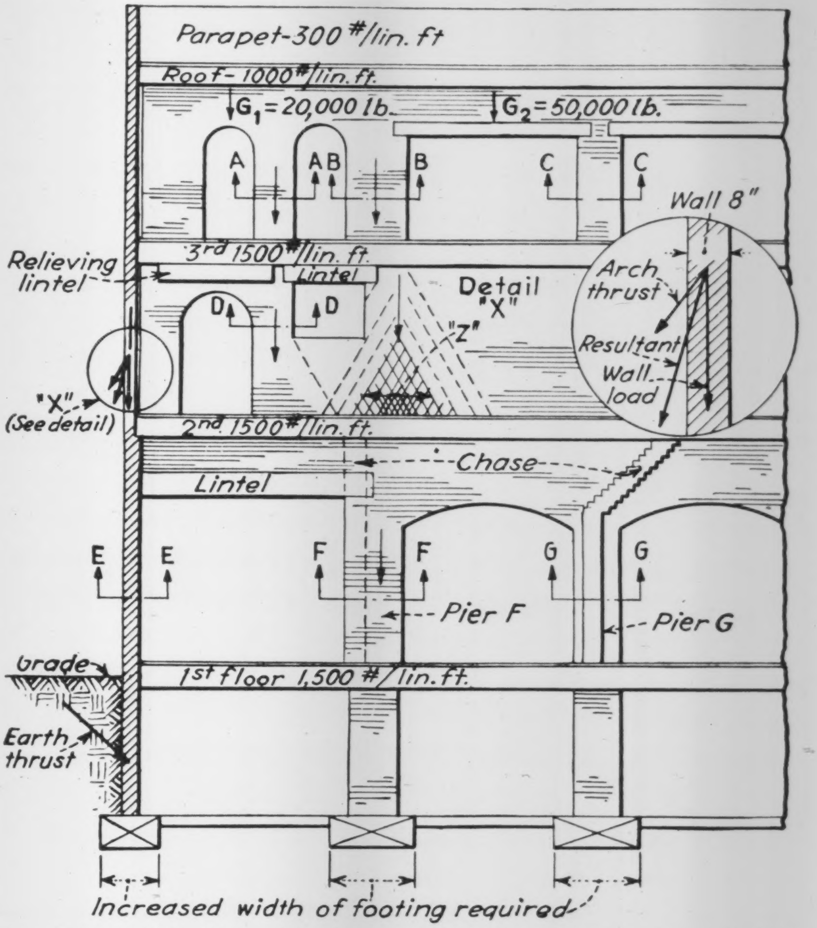


Fig. 2. Common problems of brick wall design, shown grouped in a hypothetical wall. Sections A-A to G-G involve conditions that must be watched in bearing-wall design. Foundation wall must resist earth pressure.

Lintels—a new formula

When a lintel of considerable span is introduced in a high blank wall loaded with concentrations, how much of the brickwork does it carry? Masonry is elastic and follows Young's law but has low tensile strength. The following procedure is recommended in designing to meet these conditions:

Divide the wall (Fig. 4) into arbitrary zones with the height of the lower zone not less than the span of the lintel and assume the moment on the lintel equals the sum of the static moments of all loads vertically above the lintel less the resisting moments of the beams constituted by the successive zones, provided that the cumulative stress will not exceed the safe tensile strength of the masonry. Then the moment on the lintel is

$$M_1 + M_2 + M_3 - \frac{t}{6}\left[(h_1 + h_2)\,\frac{2}{S_2} + h_1{}^2 S_1 \right]$$

$$\text{where } \frac{S_1}{S_2} = \frac{h_1 + h_2}{h_1}, \quad \text{and } S_1 + S_2 = S$$

In this expression t is the thickness of the wall and S is the safe unit stress on brickwork in horizontal tension, which in the absence of better data may be taken as 10 psi. for lime mortar and 40 psi. for cement mortar.

It may be noted that the moment carried by the masonry is somewhat less than the usual strength of a prismatic beam, i.e., $\frac{St}{6}(h_1 + h_2 + h_3)^2$. This is because, on account of the laminated nature of a brick beam, P_3 must be entirely carried by the lintel and B_2 by a beam of h_1 depth rather than of $(h_1 + h_2 + h_3)$ depth.

If this formula leads to nothing else it illustrates the importance of using relatively stiff lintels, so as to prevent wall cracks before the lintel comes into play.

The structural walls

Fig. 5 illustrates how structural action involving flexure is found in the end wall of a gymnasium. Under what condition is such a wall stable?

The wall may be tested by applying full wind pressure to it as a one-way slab between side walls, in other words on span "*l*", but it should also be given some credit for acting as a two-way slab because vertical tensile stress up to the compressive stress set up by the vertical load can be counted on.

When span and height of such a wall are excessive for the standard wall thickness, it must be thickened or buttressed. A possible alternative is to reinforce the brickwork. The reinforcement also has value in resisting explosion pressure and in counteracting temperature or shrinkage cracking. However, the designer must consider the labor difficulties likely to arise in handling reinforcing steel and brickwork by different trades.

Questions of the strength of a buttressed wall as often used in theaters, auditoriums and churches revolve around stability. The conditions are sketched in Fig. 6, where the left-hand sketch indicates side walls not supported by the end walls while the right-hand sketch indicates a roof system capable of transferring the lateral load to the end walls. In the left-hand sketch the buttresses must brace the walls against overturning, while in the right-hand sketch the buttresses merely act as vertical girders. In the first case the resisting moment is $Rt + Rl$, where R is the resultant of the load and t and l are the lever arms of R with respect to the overturning fulcrum. In this case placing the wall outside the buttress does not affect the total resisting moment materially.

Note the apparent advantage of placing the wall on the outside of the buttresses in Case II under pressure directed inward, but consider whether the wall is not as likely to be called on to resist outward pressure, for instance by the suction developed in a wind storm.

When is a wall a pier?

Some years ago the Building Code Committee of the Department of Commerce established the ratio 1:18 as a safe slenderness ratio for walls. The New York code prescribes a ratio of 1:20 for walls and 1:10 for piers. Certain handbooks provide a column formula for piers, as do also certain building codes. Here again we are in danger of being shackled by the rule-of-thumb practice. The ratio of 1:20 may not assure sufficient strength against buckling of the wall, and a 1:10 pier may be excessively slender under certain conditions. Column action, lateral load and secondary bending govern.

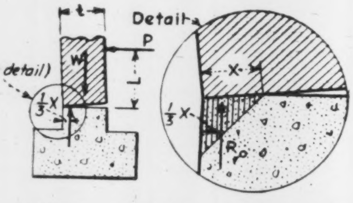


Fig. 3. Wall stability requires the pressure on the fulcrum to be less than the maximum allowable stress of the brick.

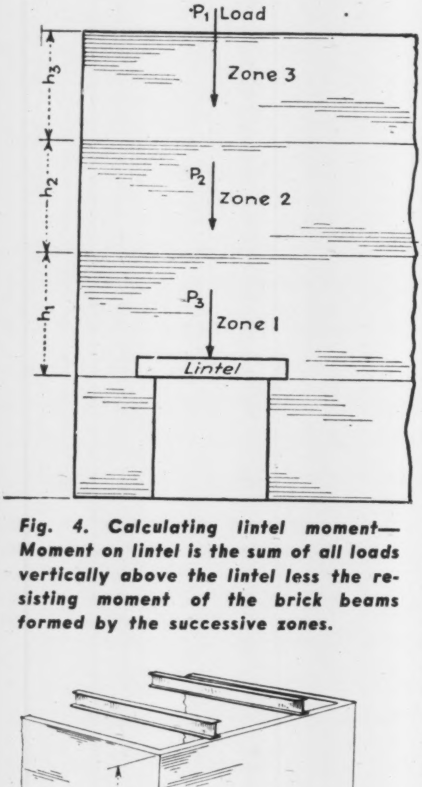


Fig. 4. Calculating lintel moment—Moment on lintel is the sum of all loads vertically above the lintel less the resisting moment of the brick beams formed by the successive zones.

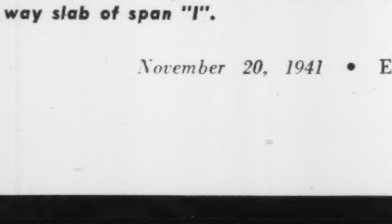


Fig. 5. Slab action on an end wall—Investigate strength of wall as a one-way slab of span "l".

Thus, a skeleton panel wall of 1:20 ratio, if of considerable length between columns and cross-walls and carrying no load, might not be safe against wind or earthquake. On the other hand, interior walls carrying no wind, or well braced walls such as those in shaftways, may safely exceed the 1:20 ratio. A 4-in. wall of brick, clay or cinder tile has great strength as a bearing partition, say up to a limiting ratio of 1:30, or even more, if well braced by cross-partitions. Similarly a pier can often be made more slender than 1:10 if under small load; a 12x12-in. pier 15 ft. high would be safe for a small load. But a 1:10 pier supporting a rather flexible girder might be subject to dangerous buckling stresses.

Slenderness ratio

If we accept the rule of practice that a bearing pier may not be more slender than 1:10 while a wall may be 1:20, the question rises when does a pier merge into a wall. As a tentative guide in proportioning walls the following ratios are suggested:

SUGGESTED SLENDERNESS LIMITS FOR WALLS

Ratio of height to length	Ratio of thickness to height
1 :1	1 :10
1 :2	1 :12
1 :4	1 :14
1 :8	1 :18
1 :12	1 :20

How serious is the bending stress that a loaded floor slab or beam imposes on a wall or pier? An idea of its importance may be obtained from Fig. 7. This shows a structure comprising a 12-in. I-beam loaded to a stress of 18,000 psi. by a uniform load of 900 lb. per lin. ft. on its 20-ft. span, supported at either end by a wall or pier 6 ft. long and 12 ft. high in both stories.

With E taken at 2,000,000 psi., rigid frame analysis shows the moments induced in the piers or walls to approximate $wl/26$, or 13,800 ft.-lb., which produces an average bending stress of 96 psi. in the masonry. The actual bending would be greatest near the beam, and in conjunction with the direct load might produce local crushing. The American Concrete Institute Handbook recommends assuming the beam restraint as $wl/24$, which would give a moment of $wl/48$

in the wall, or about half the moment found by the above analysis. It may be concluded that critical points in masonry should be investigated for secondary stresses due to floor bending.

Cracks in brick walls

Most faults in design or construction of brickwork lead to cracking. For this reason a number of points that should be constantly in the structural engineer's mind when dealing with brick walls are brought together in the accompanying table, which lists the more common types of wall cracks with notes as to cause and method of avoidance.

Comparative wall costs

To select the most adaptable type of wall for a given service the engineer or architect must have some idea of relative costs. The following costs are therefore given for use as a basis of preliminary selection and as a starting point for closer calculation by modifying the unit cost to suit those likely to prevail on the job.

These totals are based on wage rates of $1.89 per hour for bricklayers and $1.15 for bricklayers' helpers, laborers and hodcarriers.

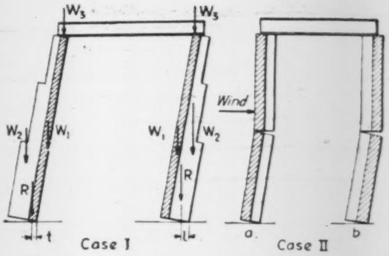


Fig. 6. Two types of loading on buttressed auditorium walls. With Case 1 there is no lateral support from end walls; with Case II the lateral load from roof is carried by end walls.

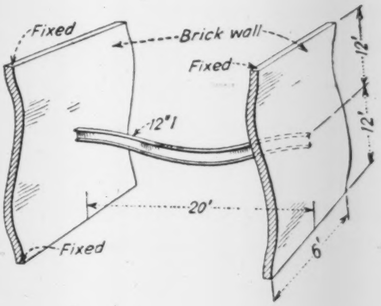


Fig. 7. Wall bending caused by girder deflection is illustrated by this drawing.

Weatherproofing of walls

With adequate craftsmanship it should be possible to lay up a 12-in. or even an 8-in. solid brick wall or a brick-faced, tile-backup wall that will not leak. But not all walls are free from leaks. If the required excellence of workmanship cannot be relied on, the furred wall is available.

The furred wall may take the form of a double wall or a wall with independent furring. Its elements are: (1) an inner surface isolated from the interior plaster or other finish, down which any seepage may trickle, and (2) provision for turning out this percolation to the exterior at floor or footing. Fig. 8 shows two constructions, a furred wall and a metal-tied double wall, the so-called cavity wall. The latter saves the cost of furring, and either construction reduces condensation and heat losses. A system of building membrane forms into the wall should also be mentioned, as it has given good results on the eastern seaboard.

Brick with a certain capacity for absorption will give better results than hard-burned or vitrified brick, as the latter will not bond well with the mortar and shrinkage cracks are likely to develop between brick and mortar through which water can drive. The minimum porosity of brick for good mortar bond cannot be set at a certain percentage but will depend on the locality in which the brick is manufactured. Beyond this, weatherproofing of walls is a matter of craftsmanship; no gadget will take the place of a well-shoved joint.

AVERAGE COST OF WALLS, CENTS PER SQUARE FOOT

Item	Brick, 12 in.	Cinder Block 12 in.	Brick, 8 in.	Composite, 4 in. brick and 6 in. tile backup
Brick, block or tile	27	26	19	24
Mortar	06	02	04	04
Scaffold	04	04	04	04
Labor	55	28	40	45
Insurance	06	04	05	05
Job overhead	10	06	07	08
Total	$1.08	$0.70	$0.79	$0.90

The cavity wall

Cavity wall construction is (in theory, at least) ideal from the standpoint of weatherproofing. From the standpoint of wall strength, however, its slenderness ratio and its bearing capacity need to be considered. Thus, if a solid wall is limited to a 1:20 ratio, what limit should apply to the hollow wall? If a solid wall

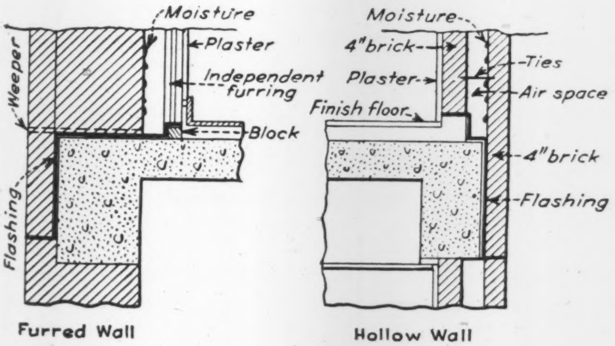


Fig. 8. Two types of double walls indicating method of using flashing to drain seepage water away from the inner face.

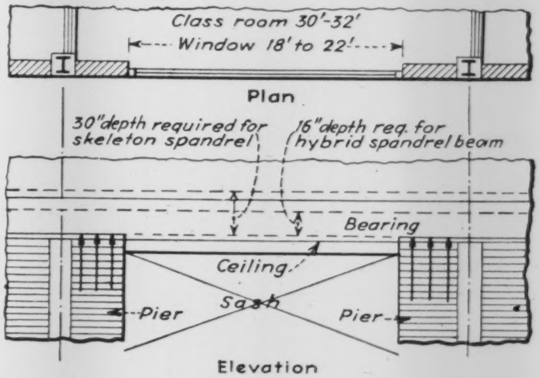
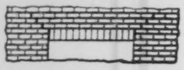
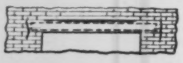
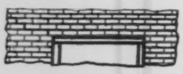
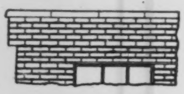
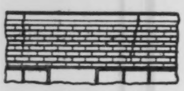
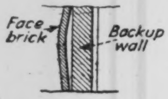
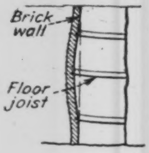
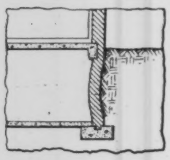
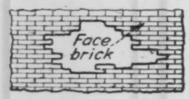
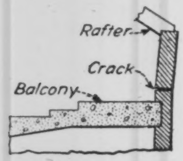

Class room 30'-32'
Window 18' to 22'
Plan
30"depth required for skeleton spandrel
16"depth req. for hybrid spandrel beam
Bearing
Ceiling
Sash
Pier
Pier
Elevation

Fig. 9. Hybrid frame construction in the Delhi, N. Y., school, where light spandrel beam is supported by the brickwork after steel erection.

COMMON TYPES OF CRACKING IN BRICK WALLS

Description	Sketch	Cause	Method of Avoidance
Flat arch		Lacking in lintel or rowlock arch support	Provide lintel or rowlock arch
Long lintel deflection		Lintel deflection	Use stiffer lintel
Corner crack		Settlement of foundation at corner	Better foundation design
Cracks at parapet and floor lines		Relative thermal expansion; continuous flashing forms slip joint	See *Engineering News-Record,* July 20, 1939. Bond slab to parapet. Corner columns
Cracks in parapet		Relative thermal expansion of parapet coping and roof slab	See *Engineering News-Record* July 20, 1939
Bulging face brick		Inadequate headers or broken headers	
Bulging wall		Floorbeams not properly anchored across building to opposite wall. Thrust may be due to thermal expansion, or to contents or to foundation settlement	Use wall anchors; tierods for granular storage or cold storage; adequate foundations.
Bulging basement wall		Inadequate section to act as a retaining wall	Use adequate thickness to resist earth and frost thrust
Surface shelled off		Salmon brick	
Top of wall overturned		Roof truss expansion	Faulty design

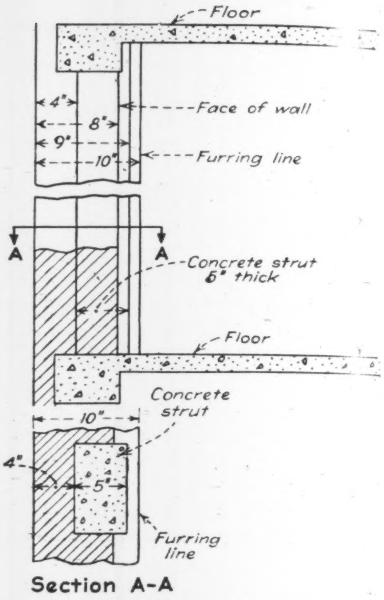


Fig. 10. Hybrid construction in the Norwalk housing project.

is limited to 250-psi. compressive stress, what limit applies to the hollow wall? Can the load be assumed distributed over both withes or is it concentrated on one withe?

Because of the ties the cavity wall is stiffer than a single 4-in. wall, or than two 4-in. walls side by side, by the mutual support of the two withes through the medium of the ties. The wall has an added element of stiffness due to its Vierendeel beam action, which is probably more effective against buckling than against transverse loads such as wind.

Tests under direct load at the Bureau of Standards showed that an 8-in. solid brick wall carried 60,500 lb. per lin.ft., a 9½-in. cavity wall loaded at the third point carried 61,900 lb., and a 9½-in. cavity wall loaded on one withe carried 50,600 lb. These figures are remarkable, considering that in the latter case the load was entirely borne by one withe. Further tests with greater slenderness ratios would be of interest.

Tests under transverse load showed the cavity wall to have a capacity of 25.3 lb. per sq.ft. against 47.9 lb. for the solid wall. As the section modulus of an 8-in. wall is twice as great as the section modulus of two independent 4-in. walls, its average strength under transverse load should be twice as great if there is no Vierendeel action. The test results indicate that the Vierendeel action is not great. However, the results are too few and the spans too small for definite conclusions.

In the absence of more complete information it is suggested that the cavity wall be used with the same slenderness ratios as solid walls, taking due account of stresses due to eccentricity. Under transverse load the wall should be rated as having only slightly greater strength than two 4-in. walls.

Hybrid frame construction

In some structures economy and strength can be obtained by judicious combination of steel frame and brick wall. This was done by the author in two recent structures, the first being on a high school at Delhi, N. Y., and the second on a low-cost federal housing project at Norwalk, Conn. The construction used may be called hybrid frame construction. The steel skeleton is made only strong enough to bear the floor construction load, while the walls are built later and swedge bricking is used to insure bearing of the spandrel on the masonry, thus supporting the spandrel rather than loading it as in skeleton construction.

Hybrid frame construction retains the advantages of skeleton construction, such as speed of erection and non-interference between steel erectors, concrete workers and brick masons. At the same time it economizes in size and weight of the steel members, and by reducing the depth of the spandrel and the size of the wall column it results in better lighting and saves space.

School classrooms are ordinarily 30 to 32 ft. long, which usually requires a skeleton frame to have wall columns spaced 30 to 32 ft. carrying heavy spandrel beams, perhaps 30 in. deep. By utilizing the brickwork as a support rather than a load (Fig. 9) the spandrel depth may be reduced to 16 in. On the Delhi job this construction was particularly advantageous, permitting the steel erection gang in this out-of-the-way location to finish its work and clean up without waiting on other craftsmen. It would have been possible also to erect the skeleton in winter and start on the masonry and concrete as soon as weather permitted in spring, which often would mean a saving of time.

On the Norwalk housing project (Fig. 10), the use of similar construction made it possible to limit the wall columns to 5-in. thickness so that furring on the 8-in. brick wall could pass the column flush. The completed structure of course was a bearing-wall job, but with the advantage over ordinary construction in that the steel ties prevented creeping and cracking.

Suggestions for Research

Among the fruitful possibilities for research in brick masonry are: (1) development of a long-column formula for walls; (2) determination of the point where, as the longer dimension of a pier becomes greater, the pier becomes a wall in long-column action; (3) tensile working-stress tests for brickwork, which are needed to design brick panels for resistance against wind and earthquake, and also for resistance against explosion; (4) as "cavity" or hollow walls are coming into use, there should be a series of tests to determine the safe slenderness ratios for the inner or bearing-wall section; (5) determination of the shearing strength by tests of the metal ties between the "cavity" walls; and (6) evaluation of the plate strength of the Vierendeel action of masonry walls.

Much of the data called for above may already have been covered by satisfactory tests, without coming to the writer's attention.

Airplane Plant Roof Truss Innovations

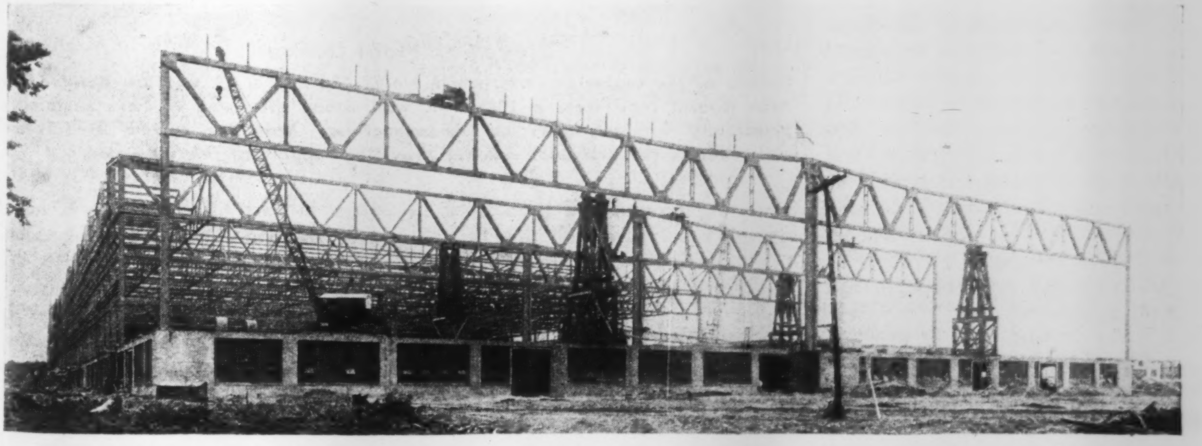
***Contents in Brief**—Columns at mid-span weighing 520 lb. per ft. and designed to support lateral load of 100x66-ft. wall area are feature of the 400x1,000-ft. Navy Building at the Glenn L. Martin Co. plant. Structure involves several other innovations and represents a distinct departure from other buildings on the site. Steel erection loads require 25x25-ft. supporting pads for cranes operating on first-floor slab.*

IN THE EVOLUTION of the modern airplane assembly building, the new 400 x 1,000-ft. structure for the Navy, at the Glenn L. Martin Plant, Baltimore, Md., designed by Albert Kahn Associated Architects and Engineers, Inc., Detroit, who designed the previous building, marks an important milepost, deserving special recognition. Notable features are: (1) steel columns at mid-span weighing 520 lb. per ft. and designed to carry the lateral force of a wind on a 100-ft. section of 66-ft.-high wall; (2) pin-connections of the 200-ft. trusses to the wall columns, supplemented by welding after the dead load is in position; and (3) the 100-ft. span of longitudinal trusses, which are of cantilever design. The building has a full-size basement, and the first floor is designed in reinforced concrete of flat slab type.

Continuing expansion

Early developments at the site of the Glenn L. Martin Co. plane plant near Baltimore, Md., were reviewed in *ENR*, Dec. 9, 1937. In the winter of 1939 a large and important addition was built at the plant involving record-breaking speed of construction, and the design and erection of this structure was reviewed in *ENR*, June 22, 1939.

During the past 18 months there has been an almost continuous extension of buildings and other facilities at the plant. These have included ad-



Completing the erection of the last of the 220-ft.-span roof trusses, which are space at 100-ft. intervals.

ditions to existing assembly and manufacturing buildings, construction of a modern engineering and design office and a new administration building. Airport landing facilities at the plant have been extended, and at the present time construction of several hangars and airport administration buildings is under way. More recently a completely separate plane assembly plant (referred to as Plant No. 2) has been built for the production of U. S. Army bombers at a site about 1½ miles distant from the main group of buildings.

In general, the design and construction of these plant and assembly buildings have not differed materially from the type of structure described in the previous articles. However, early in 1941 a contract was awarded to the Glenn L. Martin Co. for the construction of large-sized Navy planes, resulting in the development of plans for the construction of an entirely new building at the plant. Based on a required area of 400 x 1,000 ft., the design of the structure developed several innovations, making it a distinct departure from the older buildings on the site. These design features form the basis for the following description.

General arrangement

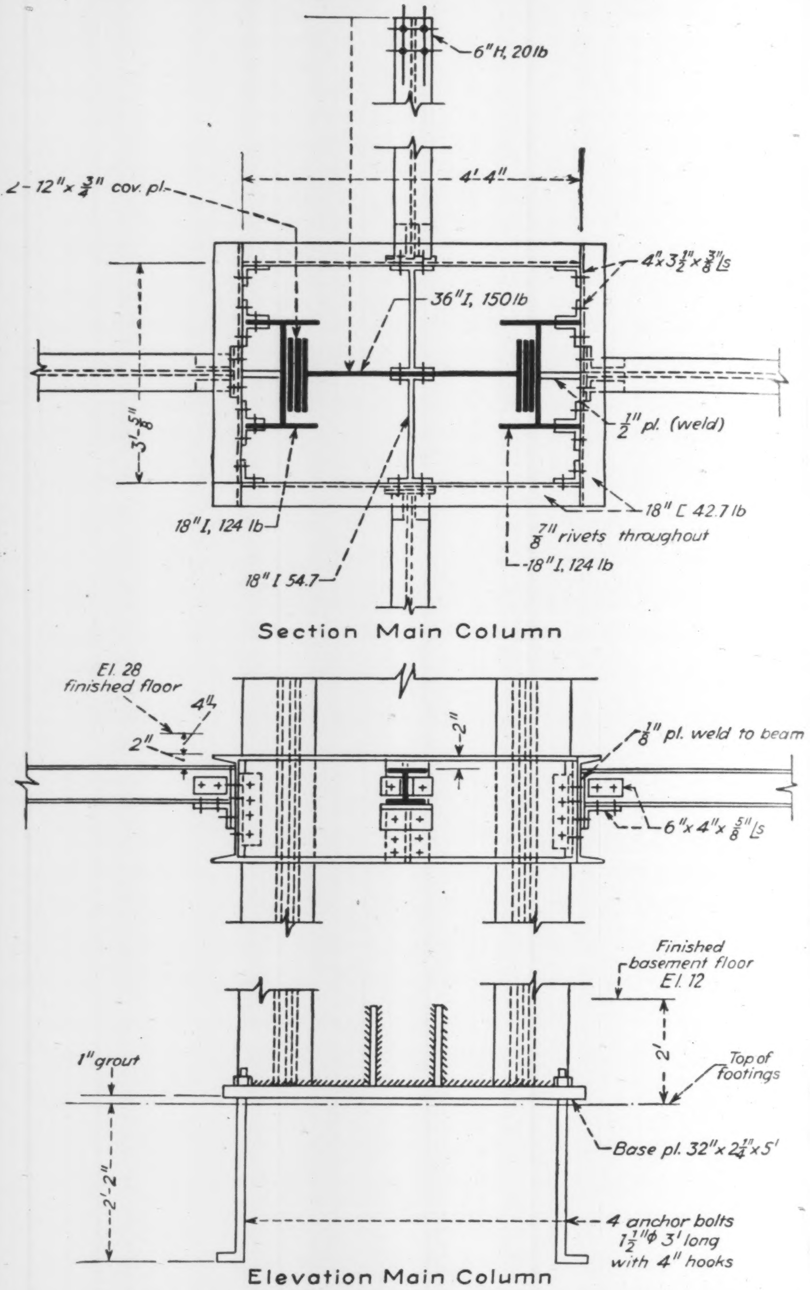
The gross area of 400 x 1,000 ft. was selected in accordance with the requirements of the Navy and plant officials. On the main assembly floor the restrictions of this gross area are reduced to an absolute minimum, involving only 15 stairways leading to the basement, 6 elevators and 15 groups of wash fountains, and two 12x15-ft. openings for hoists. On a mezzanine above the first floor are located the first-aid rooms.

In the corresponding basement area, which is of the same size, there are seven rooms occupied by the hot air heating furnaces, transformer and air-conditioning rooms, and two larger areas walled in for cleaning and finishing parts in connection with the manufacturing processes. Two first-aid rooms, toilets and wash rooms are located on a mezzanine elevation on the stairways between basement and first floor.

Foundation and basement

The building site is cut by a small depression discharging local runoff to tidewater at edge of the plant area. This depression and some of the surrounding ground had been filled in during past years with material obtained during excavation for previous buildings. This filled ground covered about 20 percent of the Navy building area, requiring pile foundations for this portion of the footings, with the remainder carried on ordinary spread footings. The typical spread footing is of 7x7-ft. size, 14 in. thick, and reinforced with 18 ½-in. square bars in each direction based on a 6,000-lb. per sq.ft. soil bearing value. The pile footings were supported by four piles each of approximately 18-ft. length, and capped with a 5½x5½-ft. concrete mat 2½ ft. thick. The special foundations required for the main columns down the center line of the building will be described later.

Provision of a basement under the entire building follows procedure that



Details of the center columns, which weigh 520 lb. per ft. and are designed to take lateral load from a 100x66-ft. wall area, with wall columns sustaining principally vertical loads on pin-connections. Note the system of I-beams embedded in the first floor slab for providing support at this elevation.

has been adopted on several of the newer buildings at the Glenn Martin plant as a result of past experience indicating the value of this space for secondary manufacturing use, as compared to the cost of providing this basement area. The cost chargeable to this extra manufacturing space was only the additional expenditure for excavating and cost of walls and first floor framing, as compared to the cost of excavation and framing required for ducts and other underground facilities. Excavation required for the full basement under the Navy Building totaled about 130,000 cu. yd. required to secure the necessary 16 ft. of height.

The basement floor consists of a 6-in. concrete reinforced slab poured directly on the ground, and can be considered a standard feature in both design and construction. The basement floor is finished with a 2-in. wood block flooring.

Footings over the basement area are spaced at 25-ft. intervals in both directions and support round concrete columns carrying the flat slab construction of the first floor. The majority of these columns in the basement are of 20-in. diameter. Incidentally, all of the free-standing columns in the basement are encased in a $\frac{3}{16}$-in. shell of steel for a height of 4 ft. above floor level.

First floor

The main assembly floor is of flat slab design in 3,000-lb. concrete for a live load of 350 lb. per sq.ft. A $10\frac{1}{2}$-in. depth of structural slab was used and the drop panels are 8 ft. 9 in. square, with an added depth of 5 in. The column capitals have a 6-ft. diameter. The structural slab is finished with a 2-in. wood block flooring. During construction of this first floor, openings were left at the location of the central columns to be concreted later after the steel columns were in position.

The approximate volume of concrete required in the structure up to the first floor level was:

	cu. yd.
Footings and foundations	2,800
Basement floor slab	7,500
Columns	1,000
Basement wall	900
First floor	13,700

Column and main truss design

Design of the supporting columns and the roof truss framing provides several unusual features representing the most notable element in the structure, as compared to the older buildings on the site. The innovations in design were developed in the office of Albert Kahn, based on general requirements established by the Navy and the Glenn L. Martin Co. These designs represent an evolution in the truss system for buildings of this type.

The general requirements established by the Navy specified two 200-ft. clear spans in the 400-ft. width of building, introducing a row of columns down the center line. A 50-ft. longitudinal spacing between these columns was accepted as satisfactory for assembly requirements. Because of the size and height of the flying boats to be assembled in this building, the vertical clearance to the bottom chord of the roof trusses was unusually high, being specified at 43 ft. above the floor level.

Advantages of a wider spacing between the main columns was obvious, and if this could be accomplished without material increase in cost, the design would represent an improvement. The depth of the main 200-ft. transverse trusses, approximately 20 ft., indicated that they might be used effectively in supporting cantilever type trusses of more than 50-ft. span. Further study of this plan showed that the longitudinal cantilever trusses could be economically extended to 100 ft. As a result the spacing of the central columns and transverse trusses was increased to 100 ft., with the cantilever longitudinal trusses spaced at 25-ft. centers across the building.

The cantilever longitudinal trusses are designed as 50-ft. cantilevers each side of the transverse trusses and are spliced at the center between transverse trusses to transfer any unbalanced loads between the cantilevers. This junction of the cantilever trusses is designed with adequate depth to secure the necessary moment resistance and rigidity, and is held in line with a bracing truss.

At the expansion joint the longitudinal cantilevers are connected with a strut pinioned to one truss at the top and to the adjoining truss at the bottom, to form a toggle joint, which permits expansion while still being capable of transferring any unbalanced vertical load.

The transverse trusses are designed as continuous over the center columns. Their depth is 17 ft. at the wall and 21 ft. at the interior column. Members were originally designed as rolled beam sections but due to a scarcity of such material at the time of fabrication, they were changed to plate and angle sections. The top and bottom chords are 4—8x8 in. angles and a $16\text{x}\frac{3}{4}$-in. plate.

A second innovation in design was to provide a center column of unusual weight and stiffness designed to take all of the lateral load from wind on a 100-ft. width of building 66 ft. high. The outside columns were designed almost exclusively for vertical load.

The nine interior columns (see drawing) are made up of one 36-in., 150-lb. H-section with two 12-in. by $\frac{3}{4}$-in. coverplates on each flange and an 18-in., 124-lb. H-section set at right angles and riveted to each flange of the 36-in. member through the coverplates. This design provided a $3\frac{7}{8}$-in. grip for the 1-in. rivets which were spaced 9-in. apart.

These columns weigh about 520 lb. per lineal foot of shaft and are more than 80 ft. long. Each column was lowered, through a hole left in the first floor slab, to rest on a concrete footing about 16 ft. 6 in. x 20 ft. with top of footing 2 ft. below basement floor elevation. In locations where piles were required, 24 were driven for each column. In all cases the thickness of the concrete footing was 3 ft. 11 in.

The wall columns designed primarily for vertical load, are 21-in. H-sections of 112 lb. Connection of the trusses to these wall columns was another special feature of the design.

To overcome the problem of bending stresses set up in the wall columns, by addition of dead load after the truss connection had been completed, the design utilized a pin-connection on the line of the top chord (see detail drawing), with a subsequent "freezing" of the bottom chord after the dead load had been applied. As a further aid in making this final adjustment, for the reduction of secondary stresses, the lower chord was provided with adjusting bolts (see detailed drawing), which permitted adjustment prior to the freezing of the connection. This joint at the connection of the bottom chord and column was designed for stiffness, with the pin-connection continuing to handle almost all of the vertical load.

To secure additional stiffness in the central columns they are inclosed at the first floor level in a structural steel frame, which, in turn, is held in position with four anchors of 6-in., 20-lb. H-beams, that extend about 8 ft. into the concrete floor slab (see drawing).

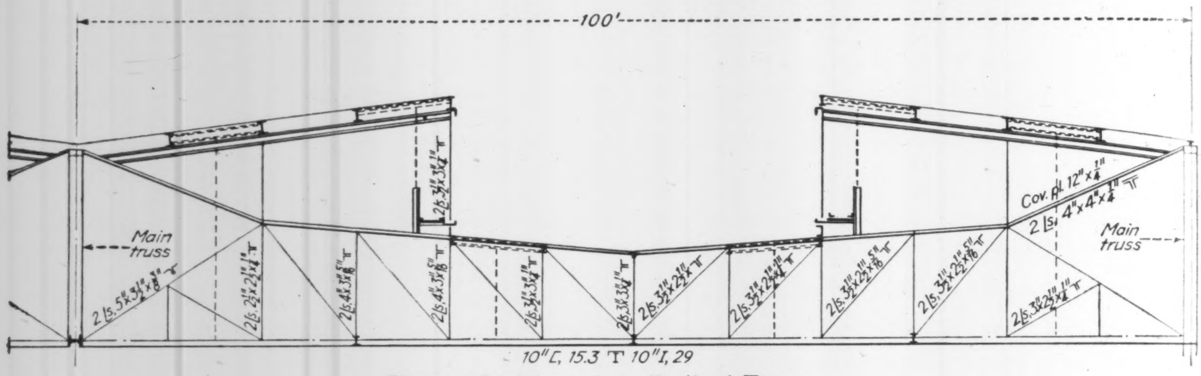
Wind bracing

The wind force on the long side of the building is taken from the wall columns into a 100-ft.-long horizontal truss, spanning between the main transverse trusses and through them into the central columns. Thus all the wind force is eventually taken by these central columns in bending.

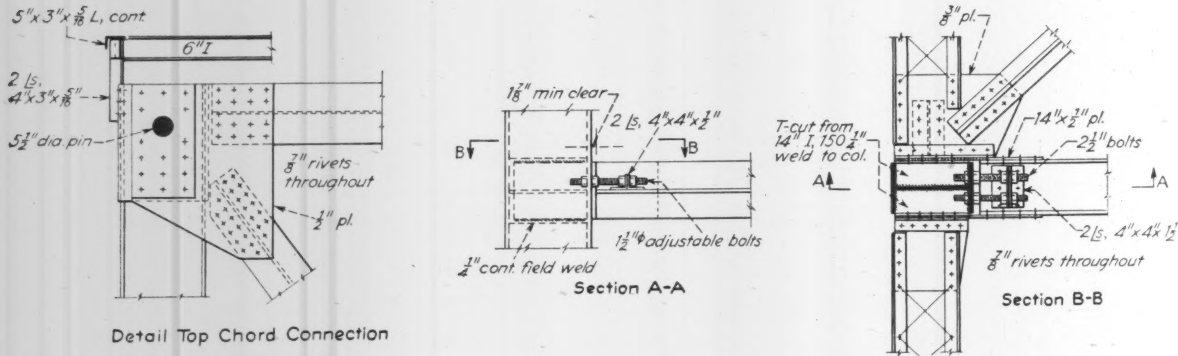
The wind force on the short side of the building is taken from the wall columns into a 400-ft.-long horizontal truss, extending from wall to wall and thence down to the ground through a system of X-bracing.

Provisions for cranes

Specifications required that the roof structure be adequate for sustaining a 10-ton crane load along parallel lines at not more than 25-ft. intervals, in both directions, over the entire floor area. The longitudinal cantilever trusses were designed for this requirement, and, of course, the main transverse trusses at 100-ft. spacing were adequate. The bracing trusses, extending between the cantilevers provided another series of lines midway between the main transverse trusses. To complete the plan, 10-in. beams were introduced midway

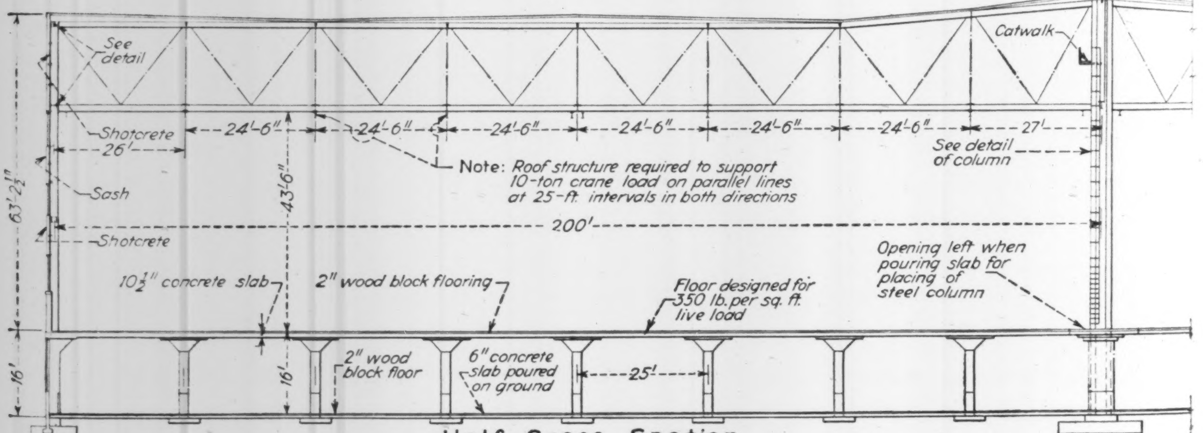

100'
Main truss
Main truss
2 Ls. 5"x3½"x⅜" T
2 Ls. 2½"x2½"x¼" T
2 Ls. 4"x3"x⅝"
2 Ls. 4"x3"x⅝"
2 Ls. 3½"x3½"x¼" T
2 Ls. 3½"x3½"x¼" T
2 Ls. 3½"x3½"x¼" T
2 Ls. 3½"x2½"x¼" T
2 Ls. 3½"x2½"x¼" T
2 Ls. 3½"x2½"x5/16" T
2 Ls. 3½"x2½"x5/16" T
2 Ls. 3½"x2½"x¼" T
Cov. Pl. 12"x¼"
2 Ls. 4"x4"x¼" T
10"[, 15.3 T 10"I, 29

Typical Cantilever Longitudinal Truss


5"x3"x5/16" L, cont.
6"I
2 Ls. 4"x3"x5/16"
5½" dia. pin
⅞" rivets throughout
½" pl.
1⅞" min clear
2 Ls. 4"x4"x½"
B
B
1½" ϕ adjustable bolts
¼" cont. field weld
Section A-A
⅜" pl.
T-cut from 14" I, 150¼" weld to col.
14"x½" pl.
2½" bolts
A
A
2 Ls. 4"x4"x½"
⅞" rivets throughout
Section B-B

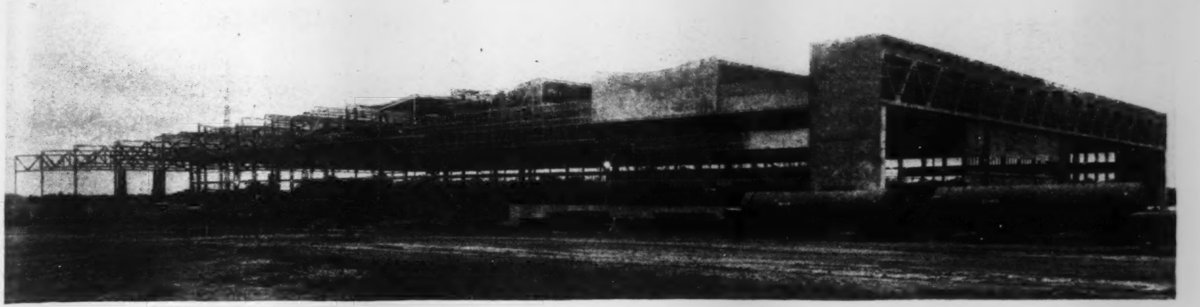
Detail Top Chord Connection

Detail Bottom Chord Connection


See detail
Catwalk
Shotcrete
26'
24'-6"
24'-6"
24'-6"
24'-6"
24'-6"
24'-6"
27'
See detail of column
Note: Roof structure required to support 10-ton crane load on parallel lines at 25-ft. intervals in both directions
Sash
63'-2½"
43'-6"
200'
Shotcrete
10½" concrete slab
2" wood block flooring
Floor designed for 350 lb. per sq. ft. live load
Opening left when pouring slab for placing of steel column
16'
16'
2" wood block floor
6" concrete slab poured on ground
25'

Half Cross Section

General dimensions and important details of transverse and longitudinal trusses, showing chord-to-column connection.



Occupying a 400x1,000-ft. area, the assembly plant has only nine interior columns. Shotcrete being applied to walls.

between the bracing trusses and main transverse trusses, supported on the bottom chords of the cantilevers. With all of the members of these lower chords in the same plane, it was relatively easy to add a supporting system for the crane track. These tracks are spaced to provide a 94-ft. span, which requires four to cover the width of the building. Cross-over tracks enable the cranes to be doubled up for use in any one bay.

Transverse monitors are provided at 100-ft. spacing and are set with a 10-ft. height of steel sash for lighting.

The roof is of relatively standard design for buildings at this plant, consisting of steel panel sections covered with a 1-in. insulating material and topped by a three-ply built-up roofing membrane.

Side walls start at the first floor level with an 8-ft. height of reinforced concrete, which was designed to provide bomb protection, among other requirements. Above this height is a 7-ft. band of steel window sash followed by a 7-ft. 4-in. band of pneumatically placed concrete wall, above which is repeated the band of steel sash, followed by the shotcrete wall up to the 66-ft. full height.

Construction procedure

Erection equipment for handling the 4,700 tons of steel included one crawler crane of 35-ton capacity with an 80-ft. boom, one truck crane of 22-ton capacity and four of 15-ton capacity. Boom lengths varied from 60 to 80 ft. with 25-ft. jibs added on all but one crane. This equipment operated from the first floor slab. In order to avoid excessive concentrated loads on the slab, two pads were constructed, each about 25 ft. square (basement column spacing) built on 36-in. I-beam frames designed to carry required loads when supported at the corners. Each of these pads weighed about 21 tons and when in use they usually rested directly over the basement columns. For erecting the center columns, weighing about 28 tons each in one section, it was necessary to carry the pads partly on shoring bents in the basement adjacent to the holes left in the first floor slab, and partly on blocking over basement columns.

Steel work started at the west end, the center column being erected first. The shaft was laid out on the slab with top end over the footing and base supported on blocking resting on pipe rollers with a bearing area of approximately 60 sq. ft. The crawler crane hook was hitched near the top end of the column; as the crane lifted the column the base rolled toward the hole above the footing until the crane boom was near enough to perpendicular to pick up the entire load and seat the column. The lighter wall columns were next set.

Main trusses (shipped knockdown) were hauled to the first floor slab by trucks, assembled in vertical position, blocked to proper camber and riveted up except at one splice near the center. The heavy section, weighing about 37 tons, was then erected using the crawler crane and a truck crane. It was connected to the center column and supported near the splice on a timber tower (see illustration). The lighter section was then erected and connected to the wall column; the splice was riveted and the tower removed. Light trusses, purlins, etc. presented no problem and followed along in order. Crane work for approximately 4,700 tons of steel was completed in nine weeks; thirteen weeks elapsed between arrival of equipment and departure of the erecting crew.

During maximum lift the slab over one of the loaded basement columns was observed to sink $\frac{3}{8}$ in. (maximum of four observations). After the load was removed, approximately half of this settlement was recovered; maximum permanent settlement observed was $\frac{3}{16}$ in. No evidence of cracks in the concrete slab has appeared up to the present time.

Lighting and heating

The working area over the entire basement will be lighted with fluorescent units suspended at an elevation of 12 ft. 6 in. above the floor to provide a 30-ft. candle intensity. The clear height required for working space on the main floor level necessitates the use of incandescent lamp units, which will consist of 750-watt lights spaced at 12 ft. 6 in. x 16 ft. 8 in. centers suspended near the level of the lower chord of the trusses. The lighting on the main floor is designed to provide 35-foot-candle intensity.

The heating arrangements consist of a forced draft hot air system from seven individually fired units installed in the basement area. In general, this system is the same as that used on earlier buildings at the Glenn L. Martin Plant, and was described in some detail in *ENR*, June 22, 1939. Briefly, the system provides outlets for the heated air near the base of the columns and along the sidewalls with return vents located on the floor along the center of the main aisles. The suction of the return vent is designed to keep the heated air in the lower part of the working area.

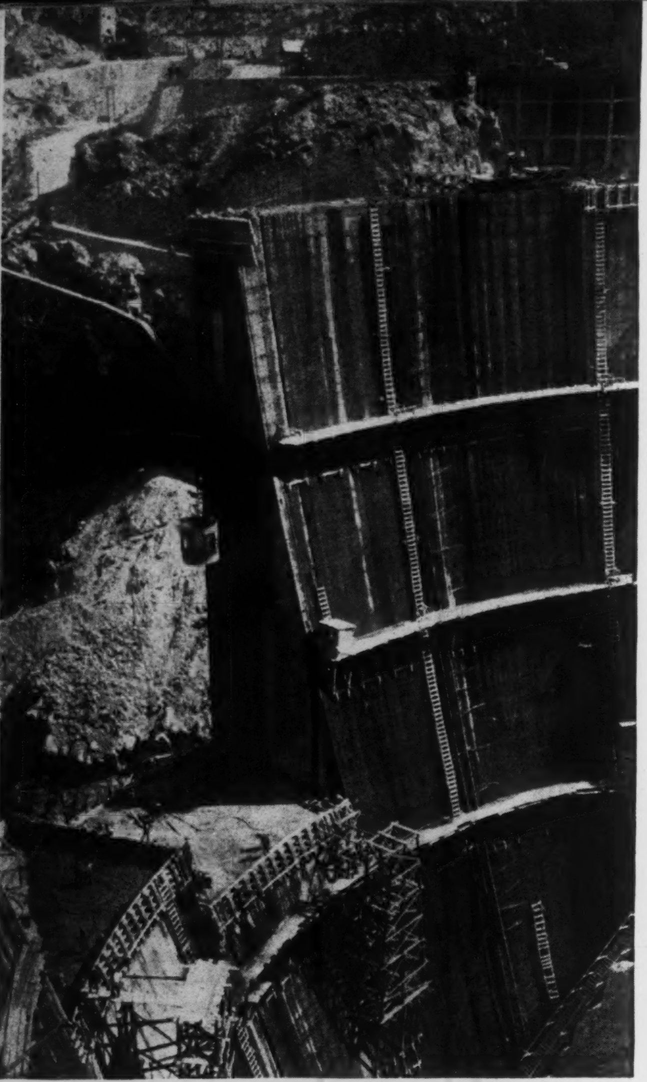
Organization

Paul E. Tignor is building and field engineer for the Glenn L. Martin Co. in direct charge of the present expansion program at the plant, including the Navy Building described in this article. G. A. Wadsworth is principal assistant.

Designs for the structure were prepared by Albert Kahn Associated Architects and Engineers, Inc., Detroit, Michigan. Frank Packard was field superintendent for Albert Kahn.

Mexico Builds A High Arch Dam On the Yaqui River

***Contents in Brief**—Angostura Dam, a 291-ft.-high arch dam on a tributary of the Yaqui River, was completed late in 1940 by the Mexican National Commission of Irrigation. The structure is the first of a series of irrigation and power dams for the development of a large river basin in the state of Sonora, a river basin that extends across the border into Arizona. American methods and equipment were used.*



Three parallel cableways were used for handling forms and concrete, concrete being brought from the mixing plant (upper left corner) to the loading bridge under the cableway (upper right) by rail cars or by trucks. Height of dam is 291 ft.

ANGOSTURA DAM of the Yaqui River Irrigation District in the northwestern part of Mexico is the first of several dams to be built by the National Commission of Irrigation to aid agricultural development of the Yaqui River valley. It is a concrete arch, designed originally to be supported directly against the walls of the canyon in which it is built, but in its completed form one end is supported by a gravity-section concrete abutment.

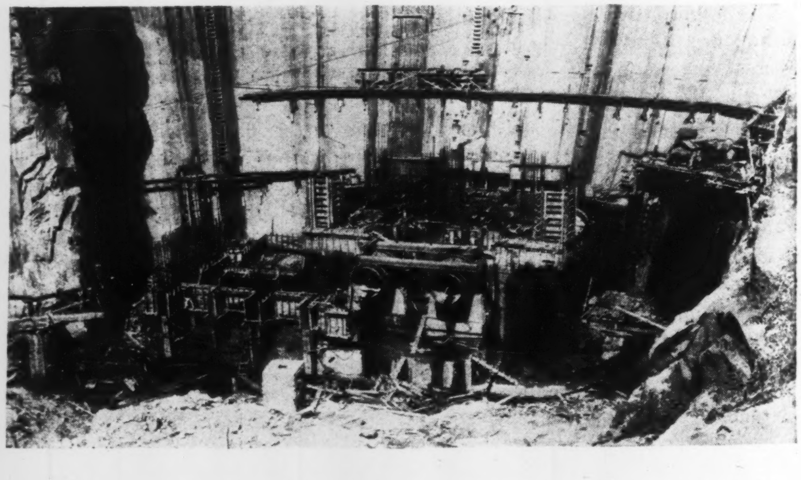
The Yaqui River watershed of 29,730 sq.mi. occupies a large part of the state of Sonora; it also extends over into the state of Chihuahua and into Arizona. Irrigation of its fertile though semi-arid lands was undertaken by private promoters years ago but made little progress, and in 1928 the government acquired the company's stock and began plans for complete development of the river's resources for power and irrigation. Three-stage development now is proposed. The first stage includes construction of two dams, Angostura and Picachos, and the development of 15,000 hp. The second stage will include construction of Camellon Dam and construction of a hydro-electric plant of 34,000-hp. capacity; and the third stage will cover construction of El Aguila Dam and the installation of 31,000 hp. more power.

Angostura Dam is located high up in the watershed on the Bavispe River, a tributary of the Yaqui, not far south of the Arizona border. It is designed to serve 247,100 acres, assuming a maximum monthly deficiency of 25 percent and a maximum annual deficiency of 15 percent. Of the total storage capacity, 81,070 acre-ft. is allocated to silt. The dam has an extra capacity of 48,630 acre-ft. for flood control.

Design of the dam

Both the shape of the canyon at the site selected for the dam and the difficulty of bringing in materials indicated that an arch of thin section should be built. The height was determined at 291 ft., and final dimensions of the cross-section and the radii were computed by the trial-load method of design.

Design studies were started in 1936



Two 80-in. penstocks through the dam supply the power plant and two 72-in. pipes equipped with 60-in. needle valves will carry the water for irrigation. The penstocks supply water to the two turbines of 8,000-hp. capacity each.

under R. S. Lieurance of the U. S. Bureau of Reclamation and were continued by the engineers of the irrigation commission. These studies were made on the assumption that sound rock in the canyon walls would be found that could serve as abutments for the arch, but in 1938 uncertainty as to the adequacy of the rock in the east abutment resulted in substitution of a gravity-section concrete abutment at that end. This assured transfer of the load to rock of adequate bearing value.

Spillway and outlet works

The spillway channel is cut through the canyon wall back of the east abutment, flow from the reservoir being controlled by two 50x50-ft. Stoney gates. Its capacity is 109,500 cfs. Below the gates the channel is laid out on a curve sloping down into the canyon, which was designed on the free vortex theory and tested by models.

The outlet works consist of four pipes built into the lower part of the arch, two 80 in. in diameter to supply the turbines in the powerhouse and two 72 in. in diameter to meet irrigation demands. These latter have 60-in. needle valves at the outlet end and two automatic oil-pressure butterfly valves back of the needle valves. The penstocks for the power plant are controlled by similar butterfly valves 80 in. in diameter. They supply water to two 8,000-hp. turbines.

Belt conveyors were used to carry aggregates over the rough terrain.

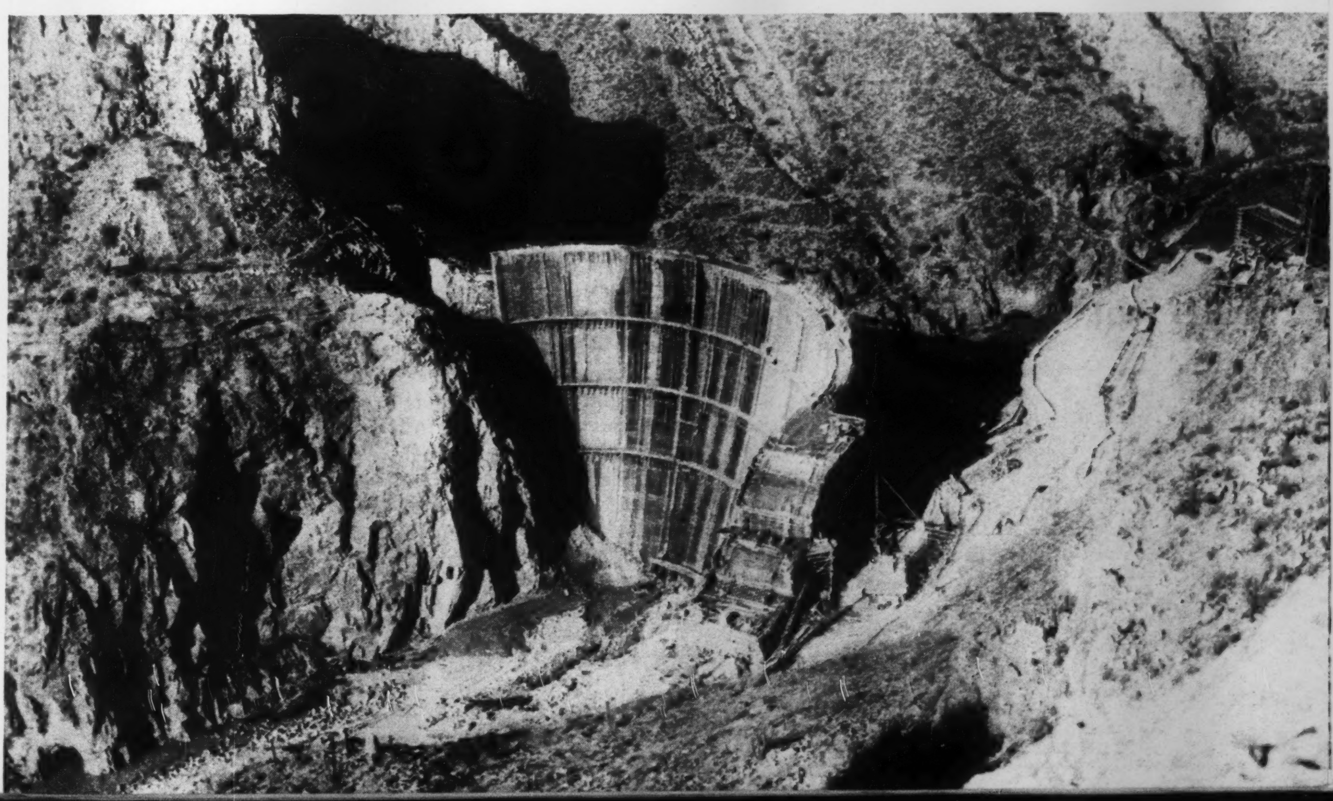
Semicircular trashracks of a design similar to that used commonly by the U. S. Bureau of Reclamation protect the upper end of the outlet works.

Construction methods reflect current practice in this country and most of the construction equipment came from this side of the border. Thus the method used to unwater the damsite was similar to that used at Boulder and other canyon sites in this country, earthfill and rockfill cofferdams above and below the dam and a diversion tunnel through the canyon wall at one side. The latter was 18 ft. in diameter and 773 ft. long, driven with pneumatic drills and muck was hauled with 15-ton trucks.

Three parallel cableways were used, spanning the canyon at an angle that gave easy access to all parts of the job. The concrete plant was on a sidehill location where gravity delivery of the aggregates was possible. Concrete was hauled from this plant in 2-yd. buckets to a point under the cableway by trucks or narrow-gage railroad cars propelled by a gasoline locomotive. Concrete was mixed with a low slump and placed with electric vibrators.

Pneumatic drills were used in excavating the spillway channel, rock was loaded with $\frac{3}{4}$-yd. shovels and transported to the dump in 5-yd. trucks.

Construction of the project was begun in February, 1937, and it was completed at the end of 1940. The work was carried out under the direction of the Comision Nacional de Irrigacion with headquarters in Mexico City. Jesus Merino Fernandez is senior engineer for the commission.



The main part of the dam is an arch, but at the east side (right) a gravity section is used as an abutment for the arch. The spillway is located across the artificial channel excavated behind the gravity abutment. The river was diverted through a tunnel in the rock on the far side of the canyon. Spillway capacity is 109,500 cfs.

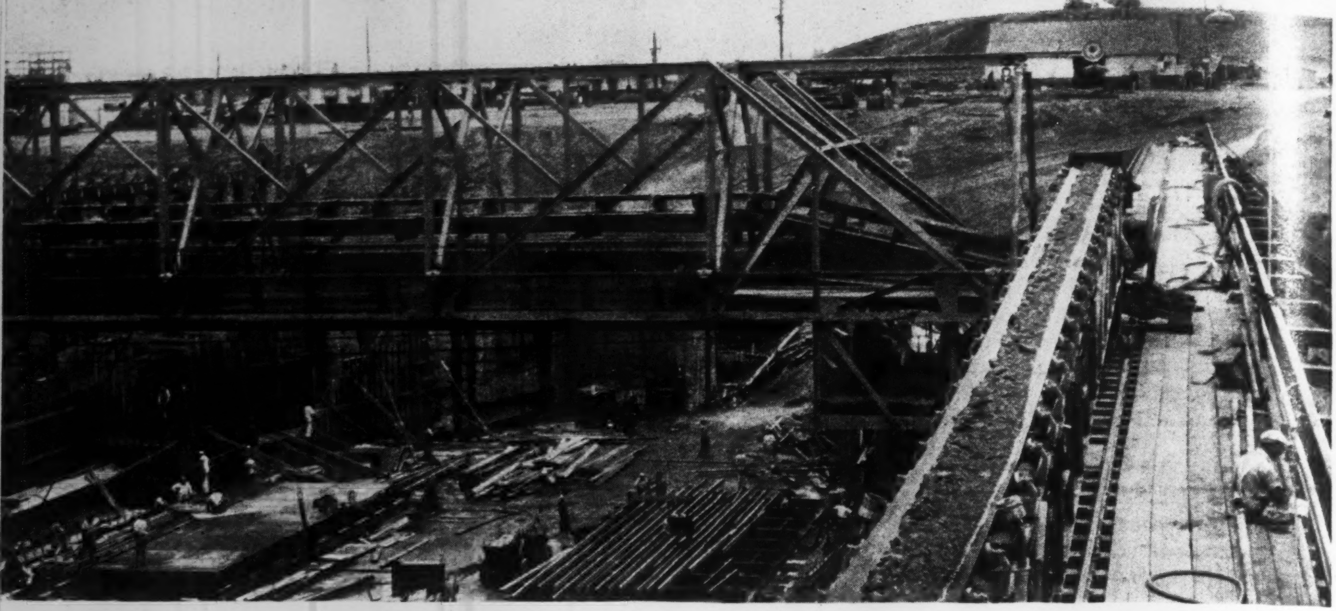


Fig. 1. Shuttle conveyor delivering concrete to the conveyor bridge on the San Diego drydock.

Drydock Concreting by Belt Conveyor

***Contents in Brief**—Concrete for the Navy drydock at the San Diego destroyer base is being delivered on a system of 24-in. belt conveyors at rates up to 180 cu. yd. per hr. The assembly includes shuttle belts, reversible double-ended belts and belts on a traveling steel bridge. Delivery is made by direct drop anywhere in a 135x720-ft. area. Uniform loading and thorough cleaning of the belts is being accomplished effectively.*

Delivering Concrete into forms in the Navy drydock at the destroyer base in San Diego, Calif., requires a system flexible enough to reach all parts of a 135x720-ft. area with differences in elevation ranging up to 50 ft. Because the placement is below ground level, it was decided to locate the concrete mixing plant to deliver a little above ground level opposite the midpoint of the drydock and to distribute by a system of conveyor belts ending in a delivery pipe whose maximum length is 50 ft. To simplify the system and to give maximum assurance of uninterrupted flow, a combination of belt conveyors was assembled which requires a minimum of operating attention and can easily complete one of the 1,400-cu.yd. floor sections of the dock in a two-shift continuous pour. Numerous details of adjustment had to be worked out, for example, a device for getting the belt uniformly loaded, a belt-wiping mechanism that would not endanger the belt and means of keeping the rolls clean. The method of unwatering the drydock site by wellpoints to permit excavation in the dry was described in *ENR*, July 3, 1941, p. 39.

Largest item in the delivery system is a movable steel bridge of 154-ft. span that crosses the dock site above the level of the highest concrete. This is supported on a pair of pile trestles about 300 ft. long built just outside the outer concrete face on either side of the dock. On these trestles are rails for trucks that support the ends of the steel bridge.

The conveyor system consists of four belts, all 24 in. in width, arranged to move at speeds and under interconnected control such that there will be a minimum risk of accumulations at any point along the system; if any motor stops, all those preceding it are automatically shut down at the same time. Shuttle conveyors make it possible always to dump at the *ends* of belts, thus avoiding traveling dumping devices.

The first belt receives concrete from the hopper under the mixers and conveys it to the belt on top of the trestle along the south edge of the dock. This belt on the trestle is a shuttle: that is, it can move in either direction along the trestle and its over-all length is enough to reach from the loading point, midway of the trestle, to either end. Being reversible, this shuttle belt can thus deliver at any point along the full length of the trestle.

On the steel bridge, which spans the dock transversely, are two belts, one fixed in position, extending from the south end to the midpoint of the bridge where it discharges to a second belt, which is reversible and is arranged as a shuttle so that it can deliver at any point under the full length of the bridge.

Routing of materials

The arrangement for handling cement at the mixing plant includes delivery by dump trucks and then lifting in a bucket elevator to a small silo above the batching floor. The system layout is such that the same elevator that lifts cement into the main storage silo also delivers to this small silo above the mixing plant. Thus the supply can come direct from the dump trucks or from storage in the large silo.

Aggregates in four sizes (sand and

rock of 1-in., 2-in. or 3-in. limits) are similarly lifted by a bucket elevator to bunkers over the two mixers, which are each of 3-cu.yd. capacity. Only the cement is automatically measured; this is done by an electric eye, which stops the motor-driven screw-conveyor at the instant the prescribed weight of cement has been discharged into the hopper. The mixer operator manually controls all other levers that charge and discharge his mixers. Time required for charging and discharging has been reduced to a total of 30 sec. so that a 1½-min. mixing period can be obtained in a complete mixer cycle of only 2 min.

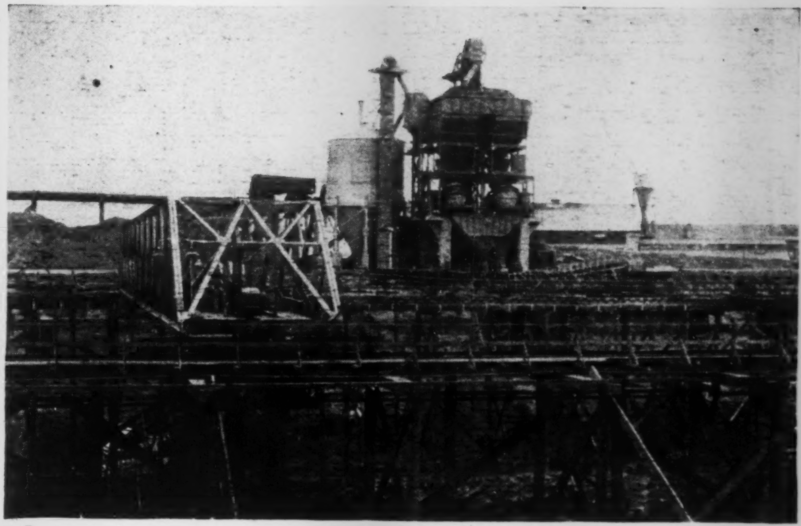


Fig. 2. Concrete mixing plant as seen from across the drydock. Aggregate piles and cement silo at left, trestle for transverse conveyor bridge in foreground.

Immediately below the mixers is a 9-cu.yd. hopper (three batches) from which flow of concrete to the belt is under constant control by a long handle operating double radial gates with which rather close regulation is obtained even in a mix including rock sizes up to 3 in. This is necessary as part of the plan for maintaining a uniform load on the belt.

Below the hopper is a 6-ft. downspout and chute discharging onto the first belt. The chute curves, at its terminus, in the direction of belt movement and where the concrete discharges onto the belt, outwardly flaring side boards some 4 ft. high are built up to form a retainer. Thus considerably more concrete than the belt can carry away can pile up here.

To protect the belt against overloading or irregular loading, despite any accumulations that may occur at the charging point, the flaring side boards have their lower edges extended by pieces of rubber belting that overlap the belt some 6 or 7 in. on either side. Thus, the effective width of the belt in the loading zone is restricted to some 10 or 12 in. At the start of operations this width was varied and belt speeds were changed until the desirable combination was obtained. (Belt speeds are about 350 ft. per min.) the operator of the gate just under the mixers keeps a reasonable amount of concrete piled up at the charging point on the belt and the result is a uniformly loaded belt that can deliver up to about 180 cu.yd. per hr. With an average throughout the job of 125 cu.yd. per hr. (1,000 cu.yd. per shift), the ideal rate of progress will be maintained.

Transfer points from belt to belt have been revised, with operating experience, to prevent spillage and to keep concrete from adhering to the belt after rounding the roll at the discharge end. Flared side boards are found most effective to provide storage capacity. Squeegee wipers, made of belting, are arranged so that a counterweight causes them to press uniformly against the belt surface *after* the belt has passed around the roll. It was found important to put these wipers beyond rather than against the roller, thus using a location where resiliency of the belt gives some play. Damage done to belts by rocks caught in wipers or other mechanisms before final adjustment was effected was considerably more harmful than a long period of normal wear. Keeping the undersides of the belts clean and free from rocks was accomplished by a sprinkle of water applied near the rolls.

In the original design the belts were operated full length in horizontal position. To get more clearance at intersections for wiping and for side boards on the belt below, the final 15 or 20 ft. of steel frame supporting some of the belts was provided with a hinge and tilted upward enough to gain the desired clearance. The belt on the bridge that receives from the shuttle on the trestle also required provision for raising the projecting end of the bridge conveyor to give clearance so that the bridge could be moved to the opposite end of the shuttle belt on the trestle. A hinge in the supporting framework and an air hoist mounted on the bridge accomplished this purpose.

Below and at the end of the bridge shuttle conveyor is suspended a hopper which terminates in an 18-in. steel pipe through which the concrete drops to the forms below. Master controls for the entire belt system are at the operator's station that moves along the bridge with this hopper. The operator here is in a position whence he can see all the work below (the platform he stands on is a steel

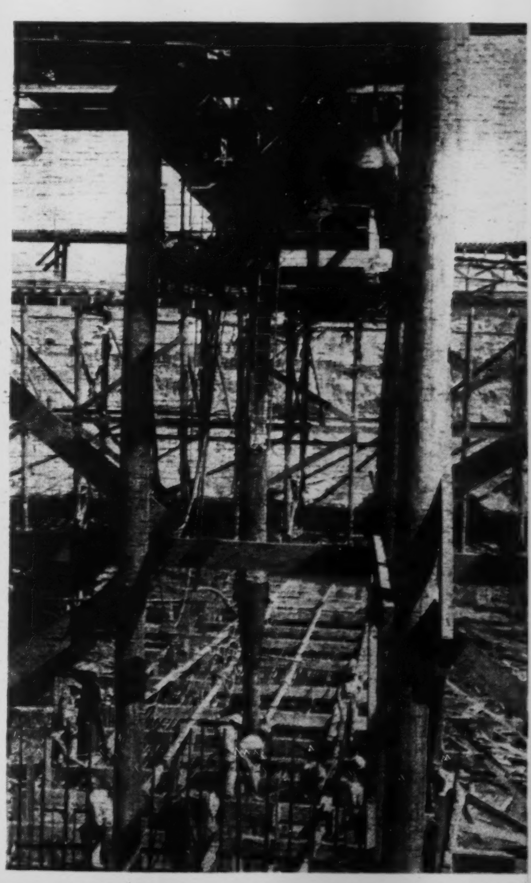


Fig. 3. Movable hopper and delivery pipe suspended beneath the transverse conveyor bridge.

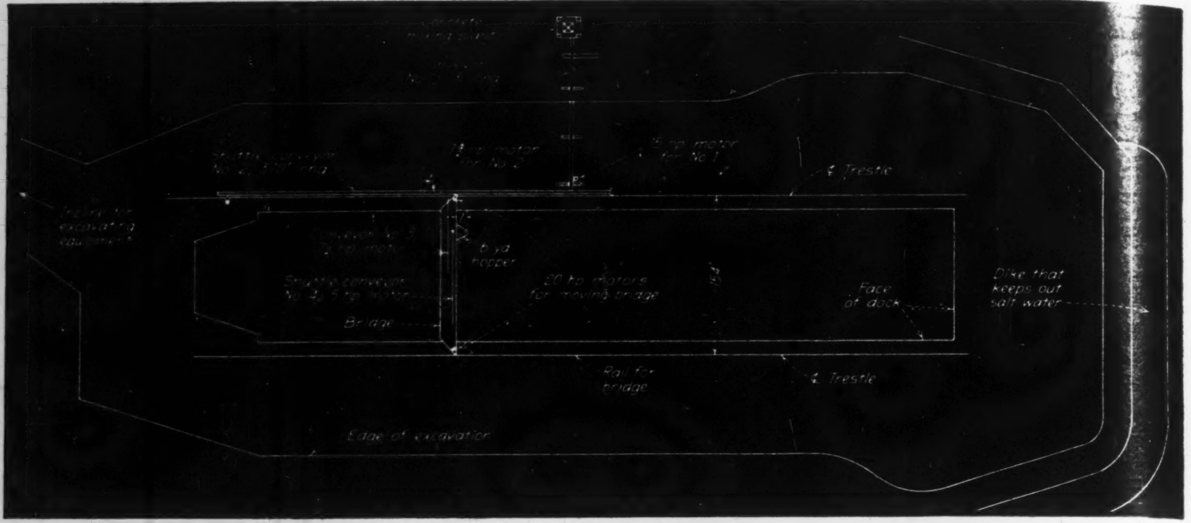


Fig. 4. Plan showing arrangement of concrete delivery system. Shuttle conveyors from mixing plant connect with conveyors on a movable bridge that spans the drydock area.

grillage) and to him go signals from the foreman of the crew in the forms. Ordinarily the entire belt system is shut down while the delivery pipe is moved over obstructions. A 13-ft. length of the delivery pipe near the bottom, tapers from the 16-in. to a 10-in. diameter and the extreme lower end consists of elephant-trunk sections that can be telescoped into one another (with the aid of an air hoist mounted above) so that the discharge end can be raised enough to move the pipe over obstructions in the forms.

Concrete is poured on the floor of the dock in sections transverse to the center line and 24 ft. wide. With maximum thickness of about 14 ft., these sections contain some 1,400 cu.yd. or less than a two-shift output of the mixer plant. Thus, no construction joints are left in these transverse blocks, which are poured by beginning at one end and advancing across the dock as the forms are filled. In this way the advancing front of the pour is always on a slope standing at the angle of repose, which is about 30 deg. with concrete such as made on this job with a 2-in. slump. Under these conditions the concrete crowds forward and around the reinforcing as vibrators work in the freshly deposited batches. The impact of the concrete itself, as it discharges from the elephant's trunk, gives a considerable vibratory effect. Surface finishers, following up the concreting crew, give the floor of the dock only a rough finish.

The crew for operating the concrete plant and belt conveyor system includes seven men per shift distributed about the work as follows: one man operates gates over the belt conveyor in the reclaiming tunnel under the aggregate storage piles. He gets his instructions (in the form of signal lights) from the man who looks after the hoppers in the top of the concrete mixing plant. There is one mixer operator and a man on the radial gates at the bottom of the hopper just below the mixers feeding the belt system. Two men are used on belt patrol (a steel worker and a laborer); they repair and keep the belts clear, clean and in operating condition. Finally, one man is required at the belt control station in the hopper car slung beneath the bridge.

The bridge track consists of a single rail on each of the supporting trestles with one truck under each of the four corners of the bridge. Each truck has four double-flanged wheels and the framework connecting truck and bridge is very rigid. An electrical contactor is so arranged that if the bridge tends to wedge by reason of one end advancing faster than the other, the motors are automatically stopped. The bridge is operated by two motors, one at each end, interconnected by an equalizing shaft extending the length of the bridge.

The job will require a total of about 80,000 cu.yd. of concrete and is scheduled for completion early in 1942.

Personnel of the civil engineer corps, U. S. Navy, under whom the work is being done, and the organization of the contractor, the Pacific Bridge Co., was given in the article describing excavation at this drydock in *ENR*, July 3, 1941, p. 76.

Chicago Terminal Plans

Changes in railway and financial conditions have led to suggested revision of Chicago's 1919 lakefront ordinance, which provided for electrification of the Illinois Central R.R. within the city limits and for the construction of a lakefront terminal station to take the place of four old terminals in the south part of the city. Electrification has been applied already to the suburban service of the Illinois Central, but its application to main-line passenger and freight service (originally required by 1930 and 1935) is recognized as impracticable under present conditions. It is proposed to omit specific dates and permit the city to say when electrification should be carried out. Meanwhile, oil-engined locomotives have been used for switching work in the lakefront yards, and it is suggested that they may be used to handle main-line work, thus eliminating complaints as to noise and smoke. As to the proposed terminal station, the Illinois Central has no power to compel other railroads to cooperate, and these several railroads evidently prefer to continue in the terminals they are now using.

Open-Cut Soil Pressures on Chicago Subway

R. S. Knapp and R. B. Peck
Department of Subways and Superhighways
Chicago, Ill.

***Contents in Brief**—Studies made in open-cut sections of the Chicago subway furnish new information on movement of soil masses during excavation and on loads on sheeting and bracing systems. Soil pressures on sides of deep cuts do not increase proportionally with depth and depart from hydrostatic pressure distribution. Sheeting found to move inward with soil mass.*

STUDIES and careful measurements made during construction of several short open-cut sections of the Chicago subway revealed new data on soil pressures, loads on struts and bracing and mass movement of soils during excavation of deep cuts. Though the information has not been completely compiled and correlated, certain facts are evident from preliminary studies of data obtained. These include the revelation that in deep cuts in clay the soil pressure against sheeted sides does not follow hydrostatic laws—i.e., increase proportionately with the depth—but reaches a maximum at from 0.4 to 0.5 the depth of cut measured from the bottom. This means that the usual procedure of progressively lessening the vertical distance between horizontal struts as the excavation deepens is unnecessary, and that the heaviest bracing should be at and just below the mid-depth of the cut. Another interesting phenomenon observed was the inward movement of sheeting as excavation progressed, determined simply to be a combined movement of mass soil and the sheeting. Raising of the bottom of cut is part of the mass soil movement.

Conditions investigated

Although the major portion of the Chicago subway was built in tunnel, certain sections were constructed in large open cuts, approximately 50 ft. wide and varying in depth from 35 to 45 ft. The soil in the upper 8 to 12 ft. was usually an accumulation of fill, sand and silt containing the permanent groundwater level. Below the fill the soil was a plastic blue clay, relatively stiff in some cases and exceedingly soft in others. Construction methods differed, inasmuch as details of the bracing were determined by the contractor in each case. In general, however, either solid walls of steel sheetpiling were driven in advance of excavation along the boundaries of the structures, or steel H-piles were driven at 5 or 6-ft. intervals, providing for the insertion of lagging boards as excavation proceeded. As excavation deepened, wales and struts were added, either of steel or wood.

Extensive observations were carried out on six of these open cuts to determine the loads carried by the bracing system, and the movements experienced on account of the construction of the structures. The results covered a wide range of soil conditions and construction operations, and disclosed interesting information on behavior of soil masses during excavation.

An interesting example of the measurements made in an open cut excavated in the softest clay soil encountered in the entire subway project is shown in Fig. 2. This particular cut was 51 ft. wide and lined on each side with section MZ38 steel sheetpiling driven to a depth of 49 ft.—12 ft. below the bottom of the finished excavation.

Measurements were made on the sheetpiling as soon as they had been

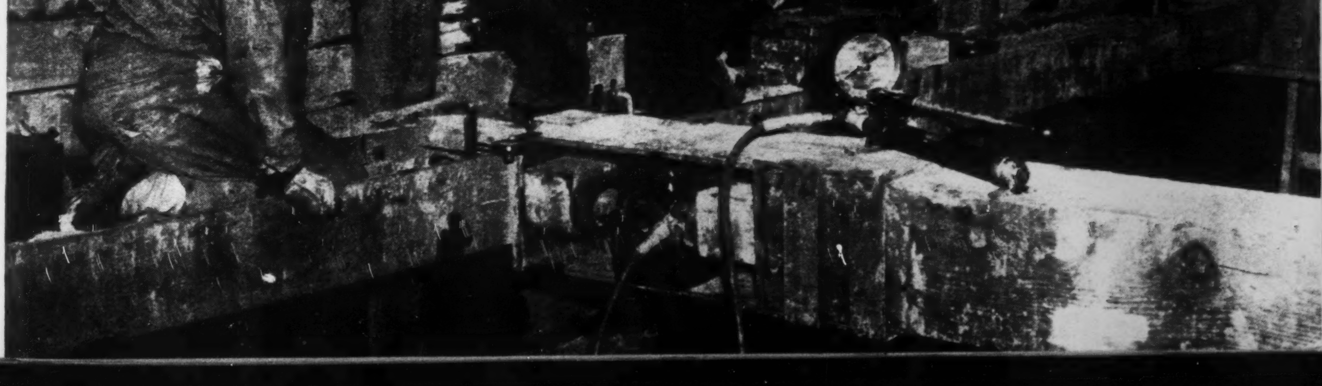
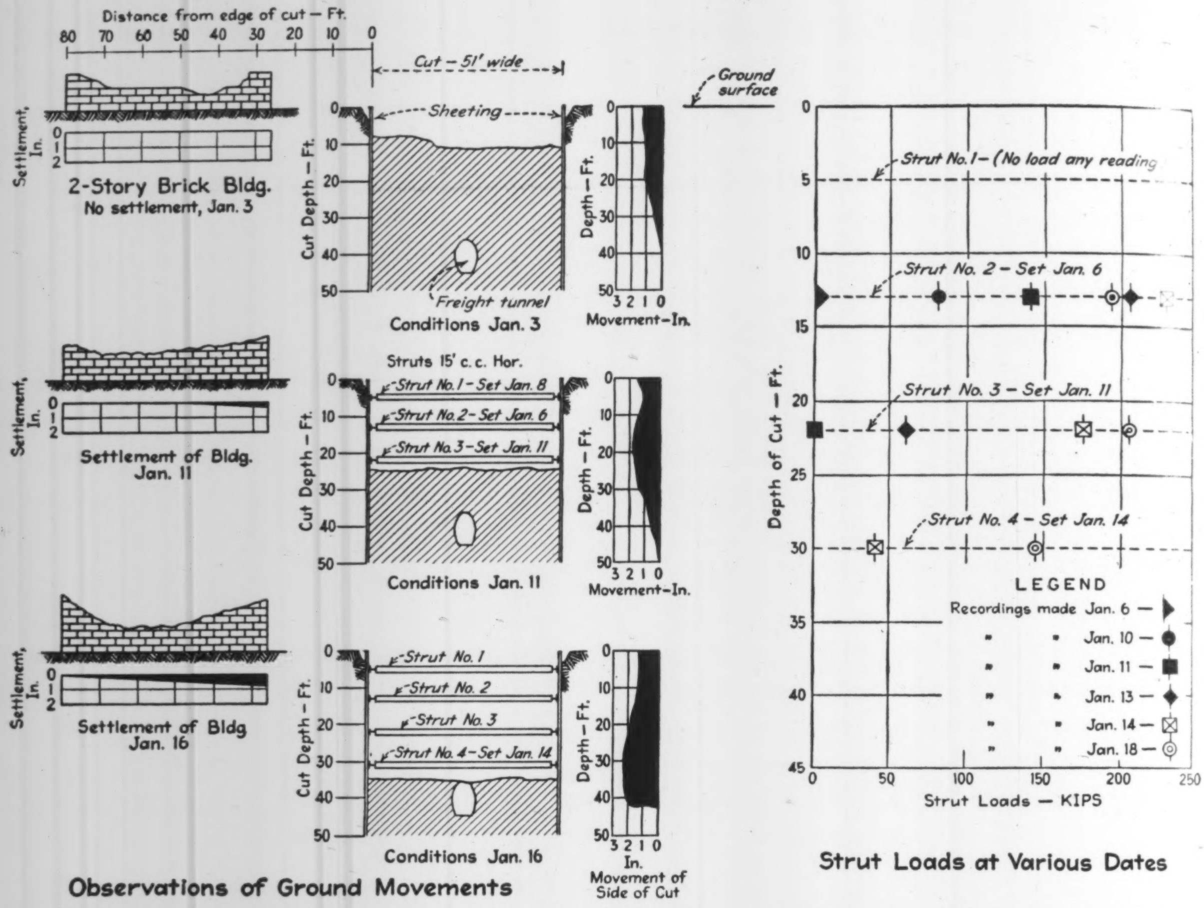


Fig. 1. Jack installation for measuring strut loads in open cuts. Relation of jack to H-pile is shown in Fig. 3.



Observations of Ground Movements

Strut Loads at Various Dates

Fig. 2. Observed ground movements and strut loads at various dates in typical open-cut soil pressure investigation.

driven and were continued through the excavation process. Movement of the top of piling was measured with respect to a fixed reference point, and movements of other points on the piling relative to the top of the piles were determined by measuring offsets to a plumb line dropped from the top. In this particular excavation there was a small freight tunnel below the bottom of the cut directly on its centerline, which was utilized to measure movements of the sheetpiling 4 ft. below finished grade, transverse pipes being driven through holes broken through the side of the tunnel to firm contact with the sheeting. Movements of the ends of these pipes reflected any inward movement of the sheetpiling at this low elevation. When the excavation was completed and the sheetpiling was exposed to grade its exact position in space was determined, and at the same time readings were made on the pipes. With this information it was possible to reconstruct all of the previous positions of the sheetpiling even at points that were still buried in clay on a given date.

Measured movements

The measured movements are shown in Fig. 2, together with the excavation progress and the time at which struts were placed. The first struts were set at a depth of 12 ft., when excavation had reached 13 ft. It was interesting to note that even by this time the sheetpiling had experienced a considerable inward movement at the top of the cut and that the general nature of the movement of the sheetpiling was an inward displacement approximating rotation about the bottom of the piles. The piles remained practically straight during the process. After the strut was placed at a depth of 12 ft., no more deflection occurred at this elevation, but subsequent excavation to 23 ft. produced a further inward movement of the piling below the strut. As excavation continued the points where struts existed experienced little movement, but the lower part of the piling continued to move inward until completion of excavation found the piles in an almost vertical position amounting to an inward bodily movement about 2 in. on each side of the cut.

Although struts were placed soon after excavation reached the desired level, and they were effective in preventing further important movement at their own level, movement of the sheeting at the sides of the cut nevertheless occurred below the level of the last struts placed, even before being exposed by excavation. For example, it is seen from the measurements that when the bottom of the excavation was only at a depth of 13 ft. the sheetpiling at a depth of 41 ft. had already moved in ¼ in. on each side.

Accompanying the inward movement of the sides of the excavation was an upward movement of the soil inside the sheeting. Displacement in this case was observed by establishing a set of levels in the crown of the freight tunnel. An upward movement of ½ in. occurred by the time excavation had reached 29 ft., or 7 ft. above the top of the freight tunnel; and by the time excavation had reached the crown of the tunnel the upward movement had reached ⅞ in. On the other hand, levels taken on the sheetpiling themselves indicated a settlement of approximately 1 in.

The combined measurements indicated that the removal of soil load between the rows of sheeting had produced an upward expansion of the material below the bottom of the excavation which resulted in an inward movement of the sides. The latter phenomenon resulted in a subsidence of the ground surface adjacent to the cut, which dragged the sheetpiles downward. Settlement observations on a structure adjacent to the profile illustrated in Fig. 2 indicate that the postulated settlement actually occurred. The measured loads in the struts, corresponding to various excavation stages, are also indicated in Fig. 2, and demonstrate without a doubt that the type of inward movement experienced resulted in nonhydrostatic distribution of pressure in accordance with the arching theories of earth pressure.

These results are typical of all of the measurements made on the open cut. The magnitude of the movements, however, was found to depend upon the stiffness of the soil. Those described above, for a cut in soft soil, were among the largest observed. In this case the average unconfined compressive strength of the soil was only 1,020 lb. per sq. ft., and the lateral movement of the piling was about 2 in. On an open cut of similar depth in a stiffer soil of an average unconfined compressive strength of 1,710 lb. per sq. ft., the lateral movement of the sheeting was about ½ in.

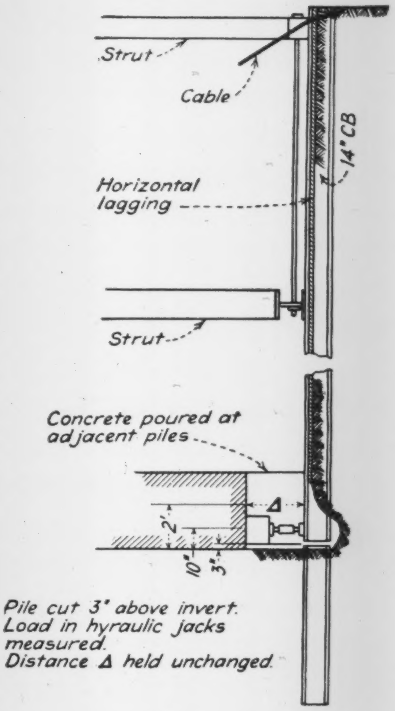

Strut
Cable
14" CB
Horizontal lagging
Strut
Concrete poured at adjacent piles
Δ
2'
10"
3"
Pile cut 3" above invert.
Load in hyraulic jacks measured.
Distance Δ held unchanged.

Fig. 3. Details of strut load measurement procedure and position of jack.

Before making these measurements, the magnitude of the movement of the sides of the cut was quite unsuspected, because of the great stiffness and amount of embedment of some of the sheeting. A study of data disclosed, however, that most of the movement of the sheeting was simple translation or rotation, and until the later stages did not include much bending of the piles. The piling simply moved bodily with the mass of soil. It is further apparent that most of the movement took place below the level of existing struts while excavation for the next level of struts was progressing. This fact implied that some of the movement could be controlled by a reasonable limitation on the vertical spacing of struts, but that the remainder was inherent in the excavation process. As a matter of fact, the generally accepted earth pressure theories indicate that the inward movement experienced by the various excavations is necessary in order to develop the shearing resistance of the soil, which reduces the earth pressure from its natural value to active earth pressure, for which the bracing is usually designed.

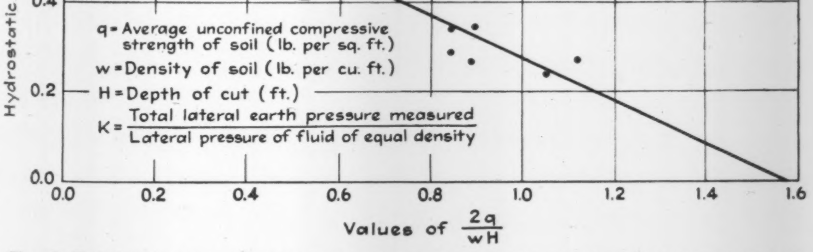


Fig. 4. Total lateral earth pressures, determined as linear function of unconfined compressive strength of soil.

The importance of the investigation of soil movements during excavation lay in the mutual relationship between the lateral motion of the sheeting and the settlement of the adjacent ground surface. Extensive experience indicated that every settlement adjacent to the excavation could be accounted for by a measured lateral displacement of the sheeting. Inasmuch as the subway was constructed in a highly congested section of Chicago, it was of prime importance that all possible precautions be taken to prevent the settlement of adjacent structures. Frequent but inexpensive measurements of the lateral deflection readily indicated the most favorable location for placing the bracing in order to reduce the settlements to a minimum consistent with the best methods of construction.

Determining strut loads

Complete determinations of strut loads were made on more than fifty profiles in the open cuts. Where struts were of wood, the load was determined by a pair of hydraulic jacks equipped with a pressure gage. In most cases it was found convenient to cut the strut 2 ft. short and to install on one end a steel shoe in which the jacks could be placed. To measure a strut load, load was applied to the jacks until the end of the strut tended to separate from the wale. As separation occurred it was measured by means of micrometer dials providing information for curves showing the relationship between the load in the jacks and the separation.

In cases of steel struts where small loads were expected, the same jacking technique was frequently used. For steel struts with large loads, however, a 10-in. Whittemore strain gage was used, and readings on several gage lines in each strut were made before and after the struts were placed in the cut. It was found that strut loads could be measured by these techniques with an error usually less than 10 percent. (For a complete description of techniques used and discussion of errors involved, see "The Measurement of Earth Pressures on the Chicago Subway," by Ralph B. Peck. A.S.T.M. Bulletin, August, 1941.)

The total lateral pressure exerted by the soil against the bracing was determined from the strut loads. Results showed a general consistency indicating that the total pressure for cuts of a given height was a linear function of the unconfined compressive strength of the soil.

The upper and lower limits of the hydrostatic pressure ratio for the cuts in each of the soils investigated are shown on the diagram, Fig. 3, in order that an estimate of the variations in test results can be obtained. In all of the profiles measured, the distribution of lateral pressure was found to be non-hydrostatic with the center of pressure lying between 0.40 and 0.52 of the depth of cuts, measured from the bottom, with an average of 0.43. In the field tests, for cases where the embedment of the piling was apt to be of importance, the piling was burned free at the base of the excavation to determine the magnitude of the force transferred to the pile by the soil below the bottom of the excavation.

The soil mechanics program on the Chicago subway project was carried out by the Department of Subways and Superhighways, city of Chicago, Philip Harrington, commissioner. Ralph H. Burke was chief engineer through the major construction program; Charles E. DeLeuw is now acting chief engineer. R. S. Knapp is in charge of the survey section, including soil testing. Dr. Karl Terzaghi was responsible for the general nature of the investigations, and R. B. Peck is in direct charge of the soil mechanics program, including the measurements described above.

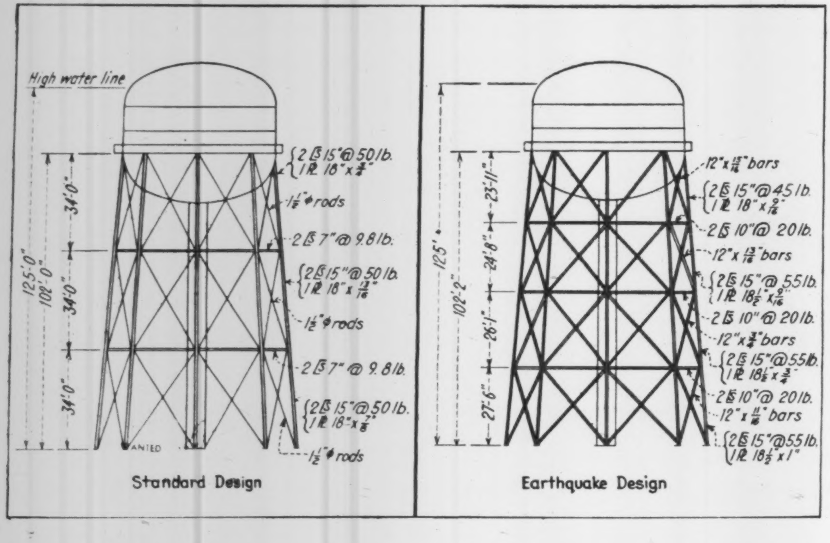
What It Takes To Be Earthquake-Resistant

Since the Long Beach earthquake of 1936 focused attention on the vulnerability of elevated tanks to seismic forces, much progress has been recorded in making such structures earthquake-resistant. The new 500,000-gal. tank built at the Tucson, Ariz., municipal airport in connection with the remodeling of this field into a military air training station is one of the best and most recent examples. Designed by the Chicago Bridge & Iron Co. for a lateral force of 0.1 gravity, it has shorter panel lengths and heavier and more rigid cross-bracing than the structure planned for vertical and wind loads only.

The accompanying drawings compare the sizes of the members in the towers of the Tucson tank with those for the same tank if earthquake forces had been omitted. It will be noted that the struts have been changed from 7-in. 9.8-lb. channels to 10-in. 20-lb. channels, an increase in section of slightly over 100 percent; and there are three lines of these struts instead of just two. Cross-bracing, instead of being 1½-in.-dia. rods, consists of 12-in. flat bars with a maximum thickness of 15/16 in. in the top panel; this represents an increase in section of over 600 percent for these members. Column sections are also increased slightly.

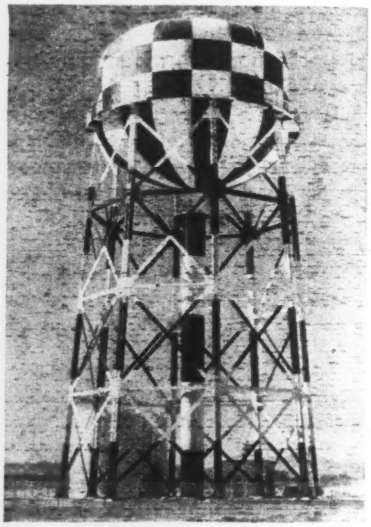
To make an elevated tank earthquake-resistant, therefore, requires a substantial increase in the steel tonnage. For the Tucson tank the increase was on the order of one-third.

Comparison of Tucson tank, designed to be earthquake-resistant, with a similar tank for which seismic forces were not figured.



Standard Design

Earthquake Design



Elevated tank at Tucson, Ariz.

Notes on the Public Works Congress

Defense and post-defense problems engaged the attention of the American Public Works Association, which met in New Orleans, Oct. 26-29. The following extracts are from some of the papers presented. A news account of the meeting, including the names of new officers, was published in the issue of Nov. 6, p. 631.

PROBLEMS IN DEFENSE AREAS

An unprecedented shift of population has occurred in consequence of defense efforts, estimates indicating that from 2,000,000 to 2,800,000 persons, exclusive of the 1,955,000 in the armed forces, have moved into defense areas. Because the controlling factor in the selection of the location of defense factories and camps was military strategy rather than the ability of cities to handle new concentrations of people, many critical problems have arisen in connection with municipal services.

The extent to which municipalities are able to meet the need for additional facilities and expanded service varies considerably among cities and depends on several factors. Among them are the ability to raise the required funds by taxation or borrowing, the condition of existing facilities and the adequacy of existing facilities prior to the emergency period. It is extremely unfortunate, however, that the great majority of communities entered this emergency defense program in poor financial and physical condition.

As soon as it became apparent that local governments could not provide the necessary facilities and services in the defense areas, steps were taken to provide federal funds and assistance. An appropriation of $150,000,000 was made on June 30 by the Congress, and the Federal Works Agency was empowered to:

1. Acquire land needed for public works facilities
2. Plan, design, construct, remodel, extend, repair or lease public works by contract or otherwise, and
3. Make loans or grants or both to public and private agencies for public works and equipment; and make contributions for maintenance and operation of public works.

Two conditions were expressly stated in the bill for a community to be eligible for aid. First, there must exist or impend an acute shortage of public works facilities that are necessary to the health, safety or welfare, of persons engaged in national defense activities; and second, it must be established that such facilities cannot be provided by local governments without creating excessive debt or imposing an excessive tax burden.

Communities at once began submitting applications in great numbers ranging from small repairs or extensions to huge new construction projects—ranging from $1,500 to $10,000,000. To Oct. 20, the total number of applications was 2,952, with a total estimated cost of $844,459,415.

It can be readily understood that the determination of the priority of projects in the defense public works program is one of the most difficult steps in the administration of the work. The FWA is utilizing the services of specialists in analyzing the need for projects in those fields where experts are available in other departments and agencies. The advice of the military and naval authorities is also obtained for the necessity of facilities near cantonments, depots and bases. — **Fred E. Schnepfe**, *executive assistant, Defense Public Works Division, Federal Works Agency, Washington.*

Discussion: Louisiana has fifteen areas wherein defense activities are causing "boom time" problems. Estimates made by the U. S. Public Health Service indicate that for every worker brought into a defense industry there are two additional members added to the community, and for every man in an army camp, there will be one civilian added to the adjacent community. At Leesville, La., the population originally was 3,300, but since Camp Polk was established six miles away, the population has jumped to almost 20,000. Only 10 percent of this number have been able to get decent housing accommodations, the balance living in garages, trailer camps, and other makeshift quarters.—**John H. O'Neill**, *chief, Division of Public Health Engineering, New Orleans, La.*

CIVIL DEFENSE OBSERVATIONS

A personal inspection of bombing damage in Great Britain made last July revealed that fire caused the greatest damage. Most of the fires have been caused by incendiary bombs, a thousand of which may be dropped by a single plane during a bombing raid. These bombs, 2 lb. in weight and 14 in. long, will burn through a roof and may pass through several floors of a building before they burn out.

Next to fire, high explosive bombs have had the greatest damaging effect. Varying in weight from 100 to 5,000 lb., the explosion of such bombs causes (1) a great outward blast which destroys walls, breaks windows, etc.; (2) followed by a suction or vacuum, which may cause just as much damage as the blast itself; and (3) a terrific disturbance in the ground, the vibrations from which may cause damage several hundred yards from the point of bomb penetration. Steel frame and concrete buildings have stood up remarkably well under bombing, but brick masonry collapses easily.

Damage to streets and utilities under bombing has been much less than would be expected. Repairs are quickly and effectively made under a system whereby contractors are employed on a cost-plus-fixed percentage fee basis. It has been found that private contractors are better able to handle this work, thus freeing the municipally-owned equipment and personnel for rescue and demolition work.—**Glenn C. Richards**, *secretary, Department of Public Works, Detroit, and member of Civil Defense Mission, Office of Civil Defense, Washington, D. C.*

POST DEFENSE PUBLIC WORKS

If we are to look forward in the post-defense period to a condition of business and employment that presents a problem in any way similar to the problems presented to us during the early Thirties, we have the obligation of examining critically the programs that have been operated over the past ten years so that we may review their virtues and their shortcomings. Like all human activities the employment stabilization programs of 1933 to 1939 fell far short of perfection. Close study discloses that most of these shortcomings can be attributed to: (1) inadequate preparation; and (2) failure to formulate a long-time policy for dealing with the problem of unemployment.

First, the programs were slow in getting started. In some quarters this was at first attributed to administrative inefficiency, but it has now been demonstrated that many months may elapse between the authorization of a major public works program and the actual employment of a great number of men on construction operations. This time interval is occasioned by the necessity of preliminary surveys, studies and investigations, to make the detail plans and specifications, to arrange for financing, to acquire land, to advertise and receive bids and award contracts, and to organize the construction operations.

What should be done now, then, if we are to be prepared for a period in the future that will present us with a problem similar to what we were faced with in 1933? An analysis of our experiences pretty clearly indicates that we should do our utmost to bring about a formulation of long-time continuing federal policies in regard to public works and employment stabilization. That policy should recognize the fact that public construction is but a portion of the entire construction field, and that the construction field itself is but a portion of the entire American economy. It should reflect the fact that the reduction in national income in the depression of the Thirties was in the neighborhood of $40,000,000,000 annually and that the total public construction volume at its highest has been in the neighborhood of $3,000,000,000 annually. The policy should be such as to minimize dislocations of otherwise existing patterns of employment, otherwise existing administrative relationships and otherwise existing financial relationships. It must take into account the characteristics of the present financial foundation of local governments.

We must do as much as possible now to prepare for a post-defense program by undertaking preliminary studies of needed projects, preparing the plans and specifications for those that preliminary studies show to be sound, where possible acquiring land for sites, and in general, doing in advance as much as possible of the preliminary work. Such work costs money and its cost may now be beyond the financial capacity of the cities and states to undertake. To make it possible to finance this, there has been introduced into the Congress an amendment to the employment stabilization act of 1931, which authorizes the making of advances to states and cities for such preliminary work and provides that the advances should carry such requirements as to reimbursement as the President might specify.

We must program now and continue to program in advance the public construction which is to be undertaken in the future. And if every city and state in the nation should pick out in advance what public construction it should undertake during the next five or six years, the task of organizing an expanded program of public works at any time would be tremendously simplified. The programming method calls for study and analysis of the public works projects proposed, study and analysis of the financial resources of the government doing the programming and the scheduling over a six-year period of projected undertakings in the light of those financial resources.

A significant place in the preparatory work I have outlined is occupied by the Public Work Reserve, a new undertaking sponsored by the Federal Works Agency and National Resources Planning Board and carried out through the assistance of the Works Projects Administration. Through the operation of the Public Work Reserve, assistance in the form of personnel can be made available to state and local governments to facilitate their works programming.

Programming of public improvements is in effect long-term capital budgeting. It can serve as a bridge between the planning operation, which is imaginative, comprehensive and farsighted, and which can become visionary, and the budgeting operation, which is realistic, hard-headed and practical, but which can be near-sighted, narrow, and wooden. Programming can introduce vision into budgeting and realism into planning. It is a bridge between these two.—**Frank W. Herring**, *assistant director, National Resources Planning Board, Washington, D. C.*

AIRPORT DEVELOPMENT

A survey of commercial airport facilities by the Civil Aeronautics Authority prior to the start of the defense airport construction program indicated there were some 4,000 airports in this country. But more than 2,000 would not meet even minimum specifications for commercial airports; only a handful of the remaining were usable from a commercial viewpoint; only five fully met Class IV specifications established by the CAA and only 31 met Class III specifications.

The army recognized the cost involved in developing and maintaining a system of airports for strictly military purposes, and was desirous of having the CAA develop commercial airports, which would be available in time of emergency for military use.

The initial construction program contemplated the development of 250 airports for which $40,000,000 was made available by the Congress. Congress subsequently provided an additional $33,000,000 to complete this program. Also made available was $62,000,000 to be applied to the construction of 149 additional airports and $5,000,000 for overseas facilities. Thus, to date the defense airport program provides for 399 airports with appropriations aggregating $140,000,000.

In the present construction program no airport has runways that will not meet at least Class III standards and many meet Class IV standards. Class IV specifications require runways with a minimum length of 4,500 ft. to permit landing under 90 percent of anticipated wind conditions. Class III specifications require similar runways with a minimum length of 3,500 ft. Actually the Class III runways are averaging 4,000 ft. and Class IV about 5,000 ft. in length. Widths have also been increased from 100 to 150 ft.—**Brig. Gen. Donald H. Connolly**, *Administrator of Civil Aeronautics, Washington, D. C.*

GARBAGE-SEWAGE DISPOSAL

Combined disposal of garbage and sewage in a single plant is a practicable method of disposal of two municipal wastes but, like any new development, is fraught with difficulties in operation that need careful consideration and further research in order to make this method fully and completely satisfactory. This paper relates experiences in the operation of the Lansing, Mich., plant (*ENR*, Sept. 26, 1940, p. 407).

Gas production records show 3 to 3.5 cu.ft. per capita per day and about 9.5 cu.ft. per pound of volatile solids put into the digestion tanks. This high gas production has led to consideration of the addition of another gas engine for generating power alongside of the one originally installed.

A mixture of sewage sludge and garbage behaves in a digestion tank practically the same as sewage sludge alone, but digestion of the mixture starts more quickly and proceeds more rapidly by far than that of sewage sludge alone. Rapid digestion of the garbage is no doubt due to the high volatile content of the garbage solids and their relative freshness.

The position of the solids in the digestion tank handling sewage sludge and garbage is a matter of considerable interest. Where sewage sludge alone will ordinarily settle to the bottom of a tank, allowing a fairly clear supernatant liquor to be taken off the top, a mixture of sludge and garbage digests so rapidly and gives off so much gas that solids are carried up to the surface and a good supernatant liquor is sometimes impossible to obtain. The four tanks at Lansing have been operated in parallel, each one independent of the other. With the frequent addition of fresh sludge and garbage, digestion is maintained almost constantly at a rapid rate. Tests have shown thick sludge at the bottom of the tank and progressively thinner sludge upward to the top. The so-called supernatant liquor instead of being clear often contains 2 percent or more of solids. Removal and disposing of such supernatant liquor is a problem.

Experimental work carried out over about a year's time shows that after the first rapid digestion takes place, the sludge, if allowed to stand without the addition of new solids, soon separates from the liquor quite completely and it is possible to draw off a fairly clear supernatant liquor. This liquor will not be at the top of the tank, however, but may be in a zone in the middle or above. Drawing off the liquor can be accomplished best by the use of some sort of adjustable draw-off pipe rather than a thick supernatant draw-off such as most plants use.

Experimental work with four small digestion tanks indicates that the best way to digest sewage sludge and garbage is by using stage digestion. Sludge and garbage were placed daily in the first tank, thoroughly mixed, then allowed to stand for nearly 24 hours. Some supernatant liquor was removed and then a portion of the sludge mixture was transferred to the second tank. The contents were then mixed and allowed to stand for another day. Supernatant was withdrawn and some sludge was then transferred to the third tank. The process was repeated in the fourth tank where the final digestion was effected and the sludge held for a longer period of time. With a constantly decreasing rate of digestive activity in succeeding tanks it was possible to obtain a progressively better sludge and supernatant so that the fourth tank produced a sludge ready for drying. It was shown that a capacity of about 4 cu. ft. per capita should be provided for parallel operation and only 1.7 cu.ft. per capita for series operation. Sludge that was filterable and properly digested for handling could be obtained in 15 or 16 days.

The first cost of the Lansing combined wastes disposal plant was $785,000, or a cost per capita of design capacity of $7.85. Additions now made and contemplated will add approximately $75,000, bringing the cost per capita design capacity to $8.50. The cost per capita of present connected population of 75,000 will be $11.50. The operating cost of $0.97 per capita per year includes the disposal of sewage and a complete treatment plant and the disposal, but not the collection, of all garbage.—Walter R. Drury, *Shoecraft, Drury & McNamee, consulting engineers, Ann Arbor, Mich.*

ARMY CAMP OPERATION

During the more than two decades preceding the present emergency, the functions of operation and maintenance of army posts did not present serious problems. Post utility officers were appointed by individual post commanders and were on the staff of, and responsible to, post quartermasters. With the completion of the recent cantonment construction program, the responsibilities of operation and maintenance changed materially. The installation of waterworks, gas, electric and sewerage systems, garbage disposal facilities, laundries, bakeries, warehouses, housing facilities, roadways, drainage systems, fire alarms, sprinkling systems, etc., presented administrative and technical problems of considerable magnitude, in fact problems equal to those of the larger cities of this country.

To meet this suddenly increased responsibility and to place experienced and trained personnel in administrative positions, army regulations have been amended to provide means of establishing "career service" for the maintenance and operation of army posts. Under this plan, army commissioned personnel trained and experienced in the maintenance and operation of post utilities may be assigned to such duties in accordance with the needs of the post and the experience of the officers, without interruption of service for a tour of duty with the troops. The Quartermaster Corps is thus training "army city managers" (with the title of Post Utility Officers) on a career basis to manage and operate facilities representing an investment in excess of $2,000,000,000.

All post utility officers are now appointed, transferred and removed by the Secretary of War upon the recommendation of the Quartermaster General. Post utility officers are responsible to the post commander for the efficient operation and maintenance of army posts, but on technical matters are permitted to contact zone constructing quartermasters through whom technical policies are determined and who are the field representatives of the Quartermaster General.

The post utility officer is responsible for all maintenance and repair work of buildings, structures and utilities other than fortifications and certain technical facilities; for all construction not handled by a constructing quartermaster, or other special agencies; for the efficient operation of all utility installations; the administration of the fire department; and the preparation of the annual, quarterly and special project estimates in defense of the annual budget. —Lt. Col. George F. Lewis, *Chief of the Repairs and Utilities Branch, Office of the Quartermaster General, War Department, Washington.*

Notes on Sewage Disposal

A monthly summary of current developments conducted by Willem Rudolfs

SOLIDS BALANCE—Determination of total quantities of sludge received, retained and handled at a treatment plant is not as easy as may be imagined. In this respect the operation of the largest chemical treatment plant in the world is of considerable interest. Schroepfer (8th Report Indianapolis-St. Paul Sanitary District for 1940) presents results for the second full year of operation. Computation of the removal of solids on the basis of analysis of the incoming and outgoing sewage and on the basis of solids actually removed and handled, showed 34,788 tons computed and 37,091 tons actually removed, with an average discrepancy of less than 6 percent. Results on sludge filtration showed a discrepancy of input and out-put of only 1.9 percent.

CONTACT AERATORS—Contact aerators are in effect contact beds continuously submerged in sewage, and thus they occupy a position between trickling filter and activated sludge treatment devices. The materials used vary from unmovable stone, coke, tile, brick, ceramic materials of various shapes, corrugated sheets, lath and brushwood to movable pieces of cork and wood. Air is used in conjunction with the contact beds. A number of years ago the use of submerged contact aerators was extensively explored and used to a considerable extent in the Ruhr District in Germany. Several plant scale trials made in this country did not produce results sufficiently favorable from an operation and cost standpoint to lead to general adoption of the system.

A few plants on a modified design have operated for several years and interest is being revived through the use of submerged contact aerators of the Hays type by army engineers for sewage treatment at air bases, particularly in Texas. According to a report made by L. B. Griffith of the Hays Process Co. to the State Health Officer in Texas, "the plants have been designed to meet high purification requirements at air bases in Texas and have been projected for use in other parts of the country."

The "Hays process" consists of two-compartment hopper-bottom aerators in which corrugated plates are set on edge, spaced 1.25 to 2.5 in. on centers. The corrugations run horizontally. A typical flow diagram comprises a primary settling tank, filter, and clarifier followed by another filter and clarifier. The principle is basically the same as that used by the Travis and Buswell colloiders and comes close to the submerged aerated contact filters of Imhoff. Results are presented, which are stated to be typical for plants treating from 0.5 to 2.0 mgd. domestic sewage with a B.O.D. of 200 to 400 ppm.

	B.O.D. Reduction	Susp. Solids Removal	Dissolved Oxygen
Primary effluent......	35.0%	55.0%	0 ppm.
1st filter and clarifier..	87.8	95.0	4
2nd filter and clarifier.	97.0	98.0	6

The cost of the plants (including bar screen, sludge digestor, sludge beds and pump house) is said to be from $3.40 to $4.00 per capita. The loss-of-head from intake sewer to outfall need not exceed 12 in. Specifications for actual design for a military camp include the requirement of 0.93 cu.ft. of air per gallon of sewage treated. Considering that modern activated sludge plants use about the same or less air per gallon the advantages of the process are not immediately apparent.

TWO-STAGE FILTRATION — Purification of milk and cheese wastes on filters in series with periodic change in the order of the filters has been investigated for several years by the British Water Pollution Research Board. The studies have been extended to settled sewage at Birmingham over the years 1938–1940 (paper presented before Institute of Sewage Purification, July, 1941). The experiments on a large scale have definitely proved that at least twice the volume of sewage per cubic yard of filtering medium can be efficiently treated by the system of filtering through filters in series, with weekly changes in the order of the filters, as by the usual system of single filtration. In other words, the capacity of two filters operated as single filters can be doubled by operating them in accordance with the method of "alternating double filtration." Although the B.O.D. of the settled sewage varied materially during the period of experimentation, there was usually little variation in the B.O.D. of the effluent from the secondary filter. Results indicate that the settled sewage varied in B.O.D. from 145 to 180 ppm. and the final effluent from 9 to 19 ppm.

In order to convert two filters from the system of single filtration to that of alternate double filtration only one additional humus tank is required to remove suspended solids from the effluent of one filter before it is supplied to the other filter, together with a pump and piping so arranged that each filter in turn can be used as the primary or secondary filter.

FILTER CAKE FUEL—The fuel value of dry filter cake is assumed to vary with the combustibles in the cake. However, the character or type of combustibles and hence the heating values per pound of combustibles varies. Results obtained by Schroepfer on chemically treated sewage (8th Report Indianapolis-St. Paul Sanitary District 1940) indicate that strictly dry-weather filter cake solids have a constant heating value at this place of about 11,000 B.t.u. per pound of combustible material although the amount of combustibles in the cake varies from 50 to 70 percent.

The addition of storm or street wash solids tends to lower the heating value per pound of combustibles. When street wash lowers the combustibles to 50 percent, this appears to change the character of the combustible material sufficient to lower the heating value on an average of 5.5 percent; when the combustibles fall below a value of 50 percent, the rate of decrease in heating value becomes greater, amounting to 12 percent when the combustibles are down to a value of 40 percent.

EXCESS SLUDGE GAS now wasted at Atlanta, Ga., could be used to operate the city's motor truck equipment at a net profit of $8,000 annually, or it could be used as fuel for boilers in the water pumping plant to save $6,400 annually, according to a report made by the Georgia School of Technology.

From Field and Office

Working problems and time-saving methods for engineers and contractors

Transforming Vertical Curves

It frequently happens that after a structure, located on a vertical curve, is designed and completely detailed, a change in the adjoining highway grades becomes desirable. An equivalent vertical curve connecting the grades has to be substituted to leave the structure elevations unchanged.

While this can be accomplished by the use of higher mathematics, a simpler and more expeditious method, (below) enables one to obtain the desired results by direct computation.

The method is based on the principle that the second derivative of a quadratic equation is a constant. This means that the curvature of a parabola with respect to the X axis is constant. Since on highway profiles distances are measured horizontally it follows that the curvature of a vertical curve connecting two grades is the same throughout the entire length of the curve. By a similar reasoning it can be shown that the change of grade along a vertical curve is proportional to the distance. For example:

Given: a + 6-percent grade intersecting a — 4-percent grade at Sta. 12+00; Elev. 125.68; V. C. 600 ft.

Required: Data for a + 4-percent grade to intersect a — 3-percent grade and be tangent to the original curve.

Distance from P. C. old curve to P. C. new curve =
2 percent ÷ 10 percent × 600 = 120 ft.

Distance from P. T. old curve to P. T. new curve =
1 percent ÷ 10 percent × 600 = 60 ft.

Sta. of new P. C. 12 + 00 minus 300 plus 120 = 10 + 20

Sta. of new P.T. 12 + 00 plus 300 minus 60 = 14 + 40

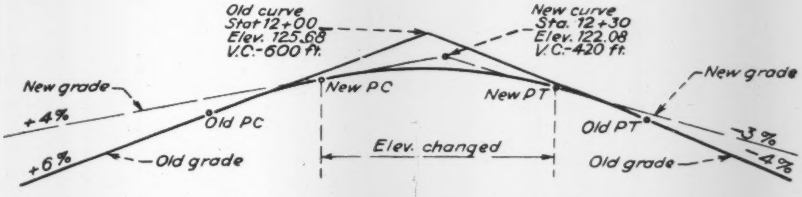
New length of V. C. 600 × 7 percent ÷ 10 percent = 420 ft.

New Sta. P.V.I. 10 + 20 plus 210 = 12 + 30

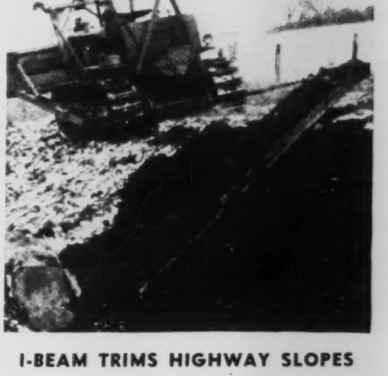
Present V. C. correction 10 × 6 ÷ 8 = 7.50

Elev. at new P. C.	Elev. at new P. T.
12 + 00	14 + 40
10 + 20	12 + 00
1.80 × 6.0 = 10.80	240 × 4.0 = 9.60
$\left(\frac{120}{300}\right)^2 \times 7.50 = 1.20$	$\left(\frac{60}{300}\right)^2 \times 7.50 = 0.30$
12.00	9.90
125.68	125.68
−12.00	9.90
Elev. 113.68	Elev. 115.78
2.10 × 4 8.40	2.10 × 3 6.30
122.08	Elev. new P.V.I 122.08

—Samuel Gisser, *Albany, N. Y.*



Transforming vertical curve without the use of higher mathematics.



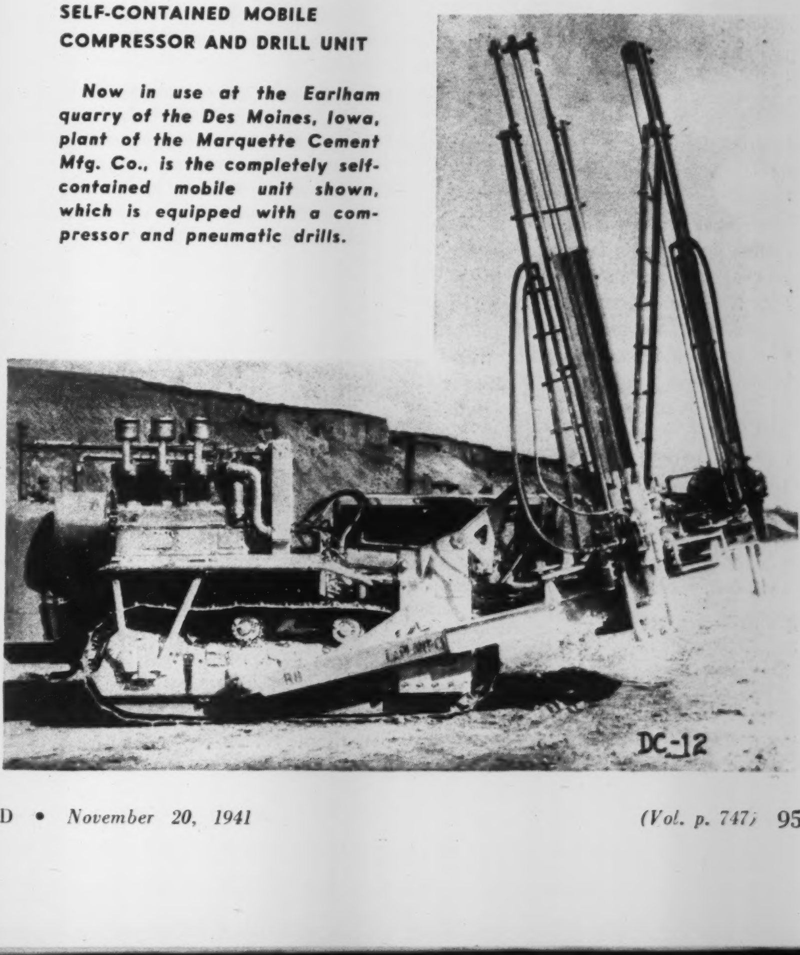
I-BEAM TRIMS HIGHWAY SLOPES

Much hand labor was eliminated on trimming road slopes on a New York State job by R. E. Tompkins, Rochester, N. Y., when he tied a 10-in. I-beam behind a bulldozer which ran along the top of the bank as shown by the accompanying photograph. Supt. W. L. Gardner and his foreman, Clyde S. Davis, thought up the idea.

For the same purpose on another contract, Arute Bros., New Britain, Conn., used a steel beam manipulated by a truck crane. — CHARLES T. FISHER, Albany, N. Y.

SELF-CONTAINED MOBILE COMPRESSOR AND DRILL UNIT

Now in use at the Earlham quarry of the Des Moines, Iowa, plant of the Marquette Cement Mfg. Co., is the completely self-contained mobile unit shown, which is equipped with a compressor and pneumatic drills.



Book Notes and Reviews

The month's addition to the engineer's reading and reference list

An Aid to Water Studies

Introduction to Meteorology—By Sverre Petterssen. 236 pp. McGraw-Hill Book Co., New York and London. Price $2.50.

Engineers interested in the prediction of rainfall and runoff for water supply and flood control studies will find much in this book to aid them in obtaining a better knowledge of the forces with which they are dealing. The book presents in an elementary manner the basic principles of modern meteorology and tells how these principles are applied to actual forecasts of future weather conditions.

For Advanced Students

STRENGTH OF MATERIALS: PART II—Second Edition. By S. Timoshenko. 510 pp. Published by D. Van Nostrand Co., New York. Price $4.50.

The purpose of the first edition of this book, namely, to develop and rationalize solutions of the more complicated problems in the fields of strength of materials and elastic theory, is unchanged in this second edition, which appears eleven years later. The principal new material relates to stresses in thin-wall construction as used in airplanes; to plastic flow in thick-walled cylinders; to bending and torsion in members stressed beyond the elastic limit; to behavior of materials at high temperatures; to beams on elastic foundations; to stresses in curved plates and shells; and to photoelastic tests. The chapters in the first edition on elastic instability of compression members and on the theory of bending of plates, which were of particular interest to structural engineers, are brought up to date in this new edition.

Street and Road Traffic

Traffic Engineering Handbook—Contributions by fourteen authors compiled and edited by Harold F. Hammond and Leslie J. Sorenson. Institute of Traffic Engineers and National Conservation Bureau, 60 John St., New York. Price $3.25.

Fourteen authorities on the many elements of traffic engineering have contributed to this pioneer attempt to bring together within the covers of one book the fundamentals of traffic engineering. The book is not prepared as a textbook; it is the result of a canvass of the members of the Institute of Traffic Engineers to determine what material would be most useful to them in a handbook. Introductory chapters discuss vehicle motion, the motor vehicle and the pedestrian and include a large amount of statistical material. Subsequent chapters take up traffic accident records, and traffic surveys, pavement marking, traffic signs and signals, including the timing of control signals, speed restrictions, one-way and through streets, roadway design, traffic islands and loading zones, curb and off-street parking, and lighting.

The Boulder Canyon Project

The Boulder Canyon Project; Its Historical and Economic Aspects—By Paul L. Kleinsorge. 311 pp. Stanford University Press, Stanford University, Calif. $3.50.

Professor Kleinsorge's subject is so rich in incident of national importance that every student of resource development will want to read and refer to the present book. The Boulder Canyon project is preeminent among great works of construction in the amazing record of controversy, preparation and difficulties that preceded its successful accomplishment. Its background embraces the development of the entire Southwest and the unparalleled topography and hydrology of its sole drainage channel and source of water, the Colorado River—in addition to such memorable factors as the irruption of the river into the Imperial Valley 36 years ago, the conflict between mountain and desert states for the river's waters, the strange international problem presented by the old Imperial Canal, and the competition for control of the Colorado's power. How these elements led to the conception of the Boulder reservoir, to the Santa Fe compact, and finally to passage of the Boulder Canyon Act and construction of the great project, is a theme of epic possibilities.

A detailed exposition of this history forms the main part of the book under consideration. This part will probably have chief appeal to most readers because of the wealth of information it offers. Perhaps the author is too conscientious at times, for excessive citation of arguments pro and con tends to obscure a clear view of the issues at some points.

In a closing chapter Professor Kleinsorge, under the heading "Economic Evaluation of the Project's Services," discusses the beneficial effects of the enterprise from a broad viewpoint. As he well says, "The services not convertible directly into money, as well as those which are salable, must be considered" in public-works undertakings, and "it is upon the broad basis of public interest, rather than upon the prospects of financial gain alone, that the economic justification of the project must rest." This justification, as presented by the author, does not proceed by dollar comparison of benefits and costs, although the title term "evaluation" might suggest a quantitative measure. Instead, he gives a skilfully stated qualitative evaluation, which leads him to the conclusion that "the Boulder Canyon Project is a development of great value to the nation in general and to the Southwest in particular."

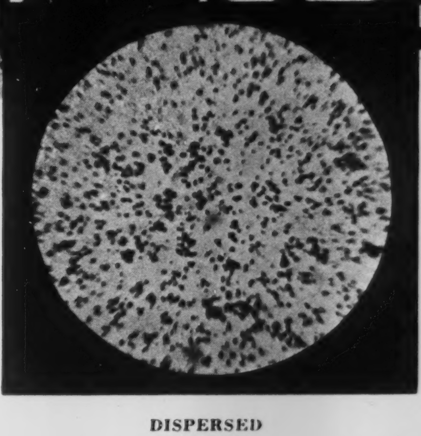
Miscellaneous Notes on Booklets and Reprints

After Defense—What? is the subject of a brief statement published in pamphlet form by the National Resources Planning Board, Washington, D. C., to direct attention to the need for post-defense planning and to report on the extent of such planning now being carried out under the direction of the board.

Revised Specifications for various types of road surfacing have been issued by the Asphalt Institute, 801 Second Ave., New York. These cover asphalt surface treatment or retreatment of old bituminous surfaces (Specification S-1); asphaltic road-mix surface course (macadam aggregate type), Specification RM-1; and asphalt road-mix surface course (dense graded type), Specification RM-2. Limited free distribution to interested parties. The changes since

(Continued on p. 104)

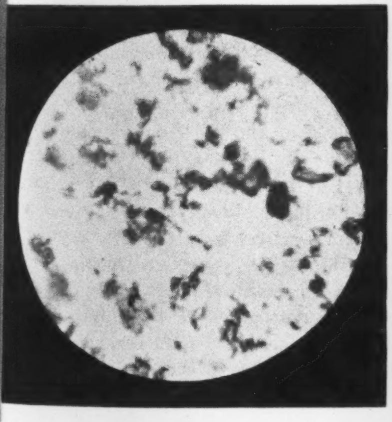
Guarantees
SAVINGS


DISPERSED

HOW CEMENT DISPERSION WORKS

Only a part of the cementitious value of the cement, whether normal portland or high early, is utilized under usual construction conditions. Investigation shows that with 28 days curing only 50% hydrates. [Anderegg and Hubbell, A.S.T.M. 29 II 554 (1929)].

Dispersed cement produces 25% to 40% higher compressive strengths.


UNDISPERSED

WITHOUT POZZOLITH

Cement particles in their normal state in water tend to gather in bunches; i.e., flocculate. Water never reaches some particles and many are only partly hydrated. This reduces the effectiveness of the cement, entraps water within the clumps, requires an excess of water for placement and often results in bleeding and segregation. See photomicrograph at left.

WITH POZZOLITH

With Pozzolith the dispersion principle operates to drive each particle apart, thus exposing all the cement particles to the vital hydrating action. See photomicrograph above.

This dispersion makes the cement usable to its maximum efficiency since all the water is made available for lubrication of the mix and the entire surface area is exposed for hydration.

BUILDERS

MASTERBUILT PRODUCTS

"*Boy,* THESE CROSBY CLIPS GO ON NICE--"
"*Yeh,* AND THEY STAY PUT, TOO

"When it comes to poker I'll bet my shirt, but for fastening wire rope I want Genuine CROSBY CLIPS and nothing else but."

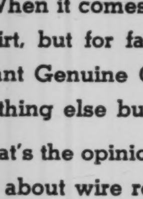
That's the opinion of men who know all about wire rope clips, by actual, first-hand experience. They KNOW that the

***Genuine* CROSBY CLIP**

leads on these four vital counts:

1. **Correct Grip.**
2. **Drop Forged Steel Construction.**
3. **Perfect Finish.**
4. **Hot Dip Galvanizing Defies Rust.**

And the Red U-Bolt tells you it's Genuine.



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AMERICAN HOIST & DERRICK CO.

CHICAGO ST. PAUL, MINN. NEW YORK

AMERICAN TERRY DERRICK CO., SOUTH KEARNY, N. J.

ABSTRACTS AND NOTES

Strategic Highway Work Includes Large Mileage

CONSTRUCTION of 4,262 miles of defense highway with the use of regular federal-aid funds and engineering work on an additional 1,548 miles was approved during the past federal fiscal year, according to the report of Thomas H. MacDonald, Commissioner of Public Roads, to Federal Works Administrator John M. Carmody. Mr. MacDonald stated that the state highway departments have cooperated wholeheartedly in applying their federal-aid funds and matching state funds to defense highways. Wherever possible these funds are being used to facilitate the construction of access roads, but the greater part of the mileage of access roads is off the designated federal-aid system.

The 4,262 miles of construction and 1,548 miles of surveys or engineering supervision of construction will cost $176,000,000, of which $98,000,000 is federal aid. The mileage is classified as follows:

	Miles
Strategic network	4,340
Access roads to—	
Army posts	910
Naval establishments	250
Industrial production areas	100
Reservation roads	200
Hawaii defense	10

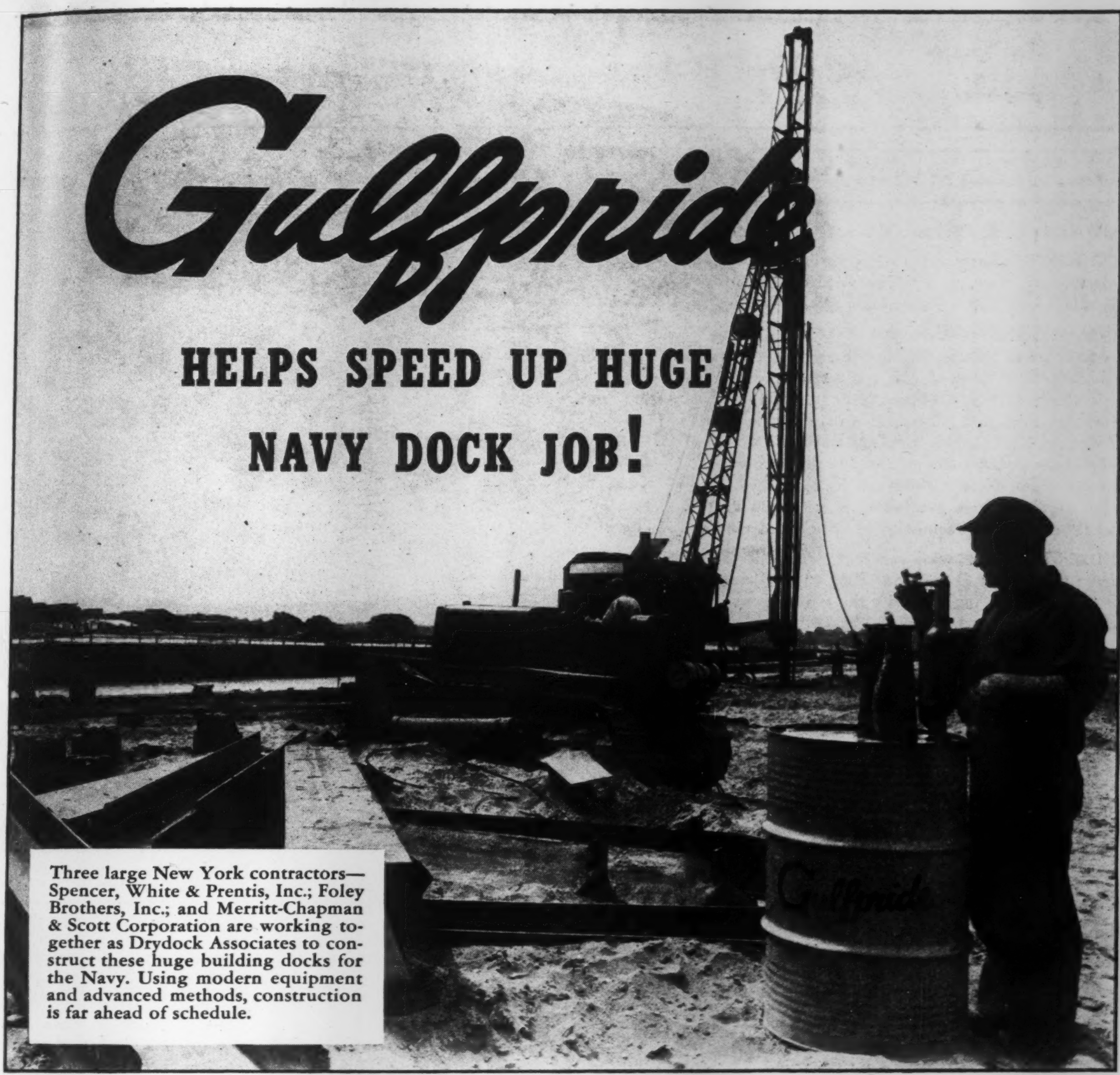
The program includes 896 structures, four-fifths of them being bridges and the remaining fifth being grade separation structures at railroads or other highways. Work on an additional 2,010 miles, including 106 structures, to cost $80,000,000, has been programmed.

In many cases defense activities have swelled traffic volumes far beyond highway capacities. For example, establishment of powder and bag-loading plants at Charlestown, Indiana, increased traffic on State Route 62 from 700 to 14,000 vehicles per day, necessitating highway construction costing $579,000. Four miles of road costing $408,000 had to be built to provide suitable access to Camp Edwards in Massachusetts where the existing route, State Route 28, had become so congested during certain periods that traffic was delayed for hours.

Defense activities in industrial Detroit have overtaxed existing streets, and $1,200,000 is now being spent to make a depressed, divided express route along a half-mile section of Michigan Avenue.

Chlorine in Water Does Not Injure Plants

Complaints by florists that chlorine in water supply causes loss of root action in plants are not supported by tests, according to a report of the Illinois State Florists Association, published in a bulletin of the State Department of Public Health. "Careful tests have failed to show that chlorine in ordinary dosages is injurious. Where organic matter is lacking the results are not quite the same. In experiments at the Boyce Thompson Institute, no plants grown in loam soil and watered with chlorinated water having 50 ppm. or less of chlorine, were injured or retarded when grown in pots in cold frames, on open benches in the greenhouse, or under bell jars in the greenhouse.... Tops of plants grown in a mixture of equal parts of loam and sand were retarded in top growth by solutions of 50 ppm. and 100 ppm. but not by 5 ppm. Roots were never injured in this soil. Plants grown in sand were retarded in root and top development by solutions of 5, 50, and 100 ppm. chlorine. Cut flowers were not affected with free chlorine in water up to 10 ppm. In experiments at the University of Illinois, carnations growing in silica gravel remained apparently unaffected when as much as 40 ppm. of chlorine were added to the nutrient solution. Since the amounts of chlorine which caused injury were considerably larger than the amounts ordinarily present in tap water, it appears that injury attributed by growers to chlorine may be due to other causes."



Three large New York contractors—Spencer, White & Prentis, Inc.; Foley Brothers, Inc.; and Merritt-Chapman & Scott Corporation are working together as Drydock Associates to construct these huge building docks for the Navy. Using modern equipment and advanced methods, construction is far ahead of schedule.

By specifying this Alchlor-Processed Oil, contractors on urgent Philadelphia Navy Yard Project insure peak performance and extra hours of trouble-free service from their equipment.

THE Navy's need is urgent—for battleships now to defend two oceans, and for facilities to build the battleships of the future. So 24 hours a day — 7 days a week — Drydock Associates are rushing the construction of huge new ship-building docks at the Philadelphia Navy Yard—each bigger than a Panama Canal lock, and capable of building 60,000-ton superdreadnaughts at record speed.

The work is being pushed along on an extremely fast schedule—a schedule which taxes equipment to new limits. Here lubrication is all important. That's why Gulfpride Oil was specified — right from the start. And why drums of Gulfpride are rushed right out on the job. For with Gulfpride, given extra endurance and lubricating value by Gulf's exclusive Alchlor Process, equipment operates at peak efficiency and has an extra margin of protection against delays caused by mechanical failures. Result: A speedier job for the Navy.

You, too, can benefit from using Gulf quality lubricants. They are quickly available to you through over 1200 warehouses in 30 states from Maine to New Mexico. Write or 'phone your nearest Gulf office today.

GULF

GULF OIL CORPORATION
GULF REFINING COMPANY
Gulf Building · Pittsburgh, Pa.

CONTRACT UNIT PRICES

What contractors are bidding on different kinds of construction work

REVETMENT, NEBRASKA

OWNER: U. S. Engineer Office, Omaha, Neb.

PROJECT: Construction of approximately 8,000-feet of revetment along Missouri River between Sioux City and Winnebago Bends, seven miles from Homer, Neb.

CONDITIONS: Government to furnish piling and lumber, contractor to furnish all other materials. Alternate methods of bidding were allowed, the contractor to furnish all materials (Method A), or the government to furnish the piling and lumber, and the contractor to furnish all other materials (Method B). All bids received were on the latter basis as the contractors were not sure of obtaining materials due to the needs of the defense program. Rail, highway and water transportation facilities available. Wage rates are: skilled labor, $1.12½c per hr.; semi-skilled, 85c.; and common, 50 to 65c.

BIDS: Three bids were received September 18, 1941, ranging from the low of $183,069 to $202,931. It is estimated that the materials to be furnished by the government will cost $22,023, thus making the total cost $205,092. This compares with the government estimate of $199,237.

LIST OF BIDDERS:

1. Woods Bros. Constr. Co., Omaha, Neb. (low) $183,069
2. Massman Constr. Co., Kansas City, Mo. 192,664
3. James Constr. Co., St. Paul, Minn. 202,931

Item	Quan.	Unit Prices (1)	(2)	(3)
1. Furn., construct, place willow mattress	850 sq.	$7.50	$9.20	$10.00
2. Const. and place lumber mattress	1,010 sq.	4.25	3.80	5.25
3. Furn., const. and place comb. mattress—willow mattress	2,665 sq.	8.00	9.50	10.50
4. Const. and place combination mattress—lumber mattress	2,665 sq.	4.75	4.10	5.40
5. Furn. and place stone on mattress	13,050 ton	3.95	4.10	4.25
6. Furn. and place stone in cast paving	8,125 ton	4.25	4.60	4.65
7. Furn. and place stone in hand-placed paving.	5,560 ton	5.30	5.50	5.25
8. Furn. and place cr. stone or quarry chips	500 ton	4.25	4.50	4.25
9. Placing piles	20,285 l. f.	.23	20	.25
10. Furn. and place suspension cables	26,040 l. f.	.04	055	.06
11. Grading	103,750 c. y.	.145	.15	.15

PUMPING STATION, HANOVER TOWNSHIP, PA.

OWNER: U. S. Engineer Office, Baltimore, Md.

PROJECT: Construction of Solomon Creek Pumping Station and appurtenant flood control work on southerly bank of Susquehanna River, North Branch, at mouth of Solomon Creek in Hanover Township, Luzerne County, Pa. Project involves diversion and care of water; construction of pumping station including entrance structure, discharge chamber, stilling basin and protective stone work; stop log structure and stop log storage box; widening and deepening existing creek channel; substation and power line; pumping units and electrical switchgear; sluice gates, flood gates, traveling crane and trash racks; power and lighting system; and remove, reconstruct and extend existing earth fill levee, including building of access road, gravel surfacing, and rock gutters.

CONDITIONS: Contractor to furnish all materials, and complete work in 300 calendar days. Rail and highway transportation facilities available. Wage rate minimums are: skilled labor, $1.00 to $1.50 per hr.; semi-skilled, 60 to 85c.; and common, 65c.

BIDS: Three bids were received October 3, 1941, ranging from the contract low of $579,353 to $733,563. Awarded October 29.

LIST OF BIDDERS:

1. Sordoni Constr. Co., Forty Fort, Pa. (contract) $579,353
2. P. J. Carlin Constr. Co., New York, N. Y. 621,032
3. Thomas M. Flanaghan, Reading, Pa. 733,563

Item	Quan.	Unit Prices (1)	(2)	(3)
1 Diversion and care of water	L. S.	$20,000.00	$29,000.00	$16,550.00
2. Excavation in borrow area	269,000 c. y.	.385	.35	50
3. Stripping	18,600 c. y.	.33	.60	40
4. Structure excavation, common	26,000 c. y.	.50	1.00	2.00
5. Structure excavation, rock	670 c. y.	5.00	10.00	5.00
6. Channel excavation, common	10,300 c. y.	.385	.50	.75
7. Backfill	6,600 c. y.	.385	.75	.75
8. Levee fill	250,000 c. y.	.025	.13	.17
9. Rolling additional trips	50,000 sq.	.005	.03	.05
10. Miscellaneous fill	1,600 c. y.	.35	.25	1.00
11. Gravel surfacing	1,400 c. y.	2.75	3.30	4.00
12. Seeding	11.5 ac.	200.00	300.00	200.00
13. Station enclosure	410 l. f.	5.00	4.40	4.50
14. Steel sheet piling	540 s. f.	3.00	1.50	2.00
15. Conc.-filled steel pipe piling	390 l. f.	7.50	4.50	6.50
16. Cr. stone backing, filters and drain.	870 c. y.	5.00	4.00	3.00
17. Riprap and rock gutters	1,440 c. y.	7.50	5.00	7.50
18. Derrick stone	110 c. y.	5.00	7.00	14.00
19. Concrete	5,150 c. y.	25.00	22.00	35.00
20. Steel, concrete reinforcement	764,000 lb.	.05	.07	.065
21. Pumping station superstructure	L. S.	25,000.00	24,000.00	20,000.00
22. Iron castings	2,200 lb.	.14	.15	15
23. Misc. iron and steel	48,800 lb.	.12	.32	.13
24. Steel; trash racks	82,000 lb	.12	.32	.18
25. Pipe handrailing, chain guards	2,470 lb.	.40	.30	.27
26. Guard fence	450 l. f.	2.29	1.80	2.00
27. Overhead power line	L. S.	1,500.00	2,500.00	2,000.00
28. Substation, 2,000 KVA	L. S.	18,194.00	18,000.00	20,000.00
29. Power and lighting system	L. S.	5,060.00	7,000.00	5,500.00
30. Metalclad switchgear	L. S.	14,597.00	13,000.00	15,500.00
31. 70,000-gpm. motor driven pump. units	4 ea.	21,000.00	20,000.00	20,000.00
32. Traveling crane	1 ea.	5,000.00	2,200.00	2,000.00
33. Monorail hoist, ¼-ton	1 ea.	1,000.00	250.00	125.00
34. Gantry crane, 4-ton	1 ea.	5,000.00	1,500.00	2,650.00
35. Sluice gates, 12 x 10-ft., rectangular	4 ea.	10,000.00	5,000.00	5,800.00
36. Automatic flood gates, 66-in.	4 ea.	1,500.00	1,400.00	1,800.00
37. Stop log davits and sockets, 3½-in.	L. S.	250.00	220.00	325.00
38. As above, 3-in.	L. S.	200.00	80.00	125.00
39. Timber, white oak	2.1 Mbm.	150.00	260.00	225.00
40. Lifting beam for stop logs	1 ea.	200.00	220.00	130.00

BREAKWATER, WASHINGTON

OWNER: U. S. Engineer Office, Seattle, Wash.

PROJECT: Construction of a rubblestone breakwater 8,200 ft. long extending easterly from mainland just north of the town of Neah Bay to Waadah Island in Neah Bay. Work located on southerly shore of Strait of Juan de Fuca, five miles east of Cape Flattery. The cost of construction of access roads or railway lines, bridges, etc., is included in the unit price bid for the stone in place.

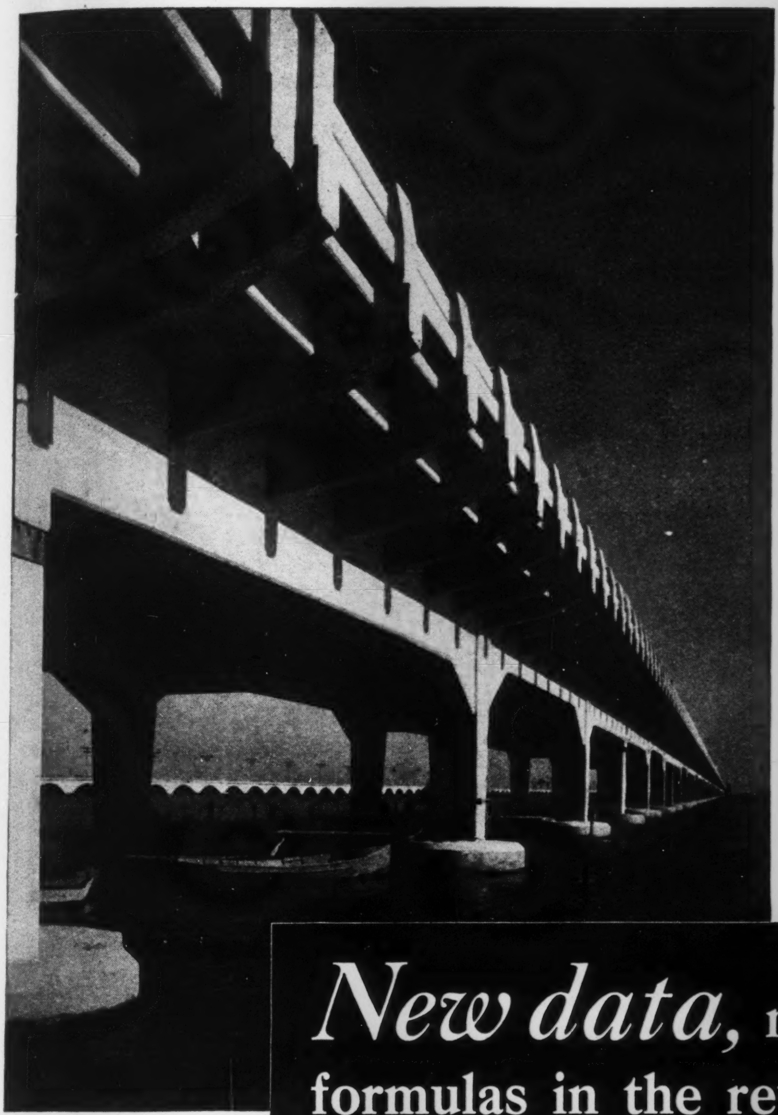
CONDITIONS: Contractor to begin work within 30 days of notice to proceed, place 30,000 tons of stone within 30 days thereafter, and the balance at an average rate of not less than 60,000 tons per month. Highway transportation available, but additional access roads or railway will have to be built. If quarry site designated by owner is used, contractor to employ as many native Indians from Makah Reservation as is possible, at the following wage rates: skilled labor, $1.20 to $1.85 per hr.; semi-skilled, $1.00; and common, 90c.

BIDS: Three bids were opened October 6, 1941, ranging from the contract low of $1,696,800 to $2,198,560.

LIST OF BIDDERS:

1. Kern & Kibbe, Portland, Ore., and Guy F. Atkinson Co., San Francisco, Calif. (contract) $1,696,800
2. Columbia Construction Co., Westport, Wash. 1,937,600
3. Teichert-Elliott-Seabrook & McDonald, Tacoma, Wash. 2,198,560

Item	Quan.	Unit Prices (1)	(2)	(3)
1. Stone, in place	1,120,000 ton	$1.515	$1.73	$1.963



The Galveston Causeway at Galveston, Texas, has 39 three-span continuous concrete girder units each 201½ ft. long. Total length, 8,200 ft.; 40-ft. roadway; two 30-in. sidewalks. G. G. Wickline, bridge engineer for the State Highway Commission. Terrell Bartlett of San Antonio, consulting engineer. Austin Bridge Co. of Dallas, contractor.

New data, new time-saving formulas in the revised edition of CONTINUOUS CONCRETE BRIDGES

The original edition of *"Continuous Concrete Bridges"* marked a big advance in simplifying office design practice for engineers applying the principle of continuity to the design of continuous T-girder and slab bridges.

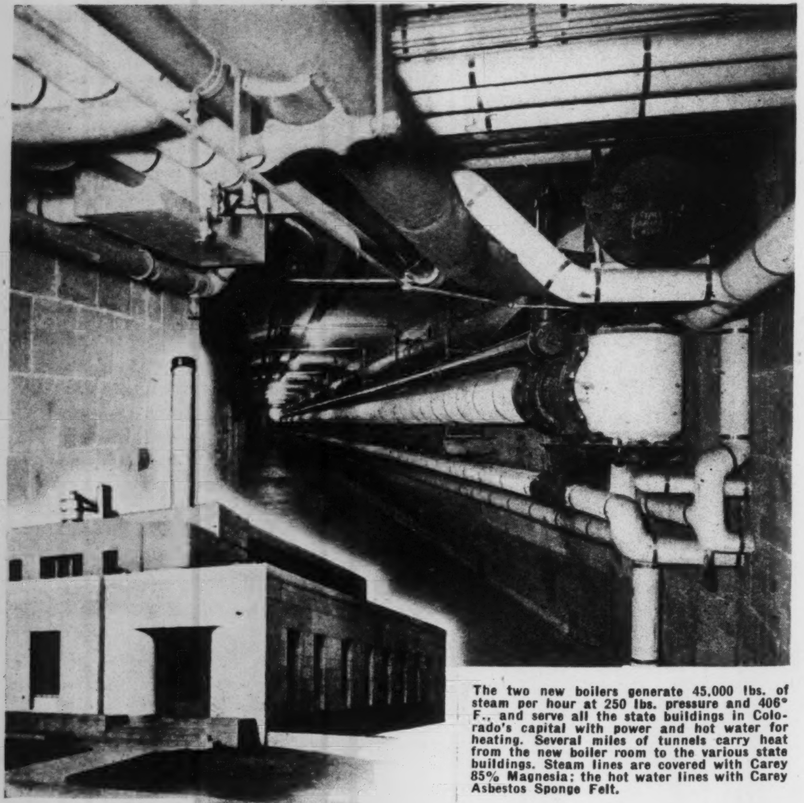
Now, this newly revised edition presents another important advance—*a simple, quick method for computing the deflection of continuous bridges*—a great time-saver for the designing engineer.

Thanks to concrete's adaptability to continuous design, the use of this highly efficient type of bridge has increased rapidly. Continuous concrete bridges offer good appearance, long life and a wide range of span lengths. There is a type suitable for almost any site.

PORTLAND CEMENT ASSOCIATION
Dept. A11c-17, 33 W. Grand Ave., Chicago, Ill.

Please send free copy of revised second edition, *"Continuous Concrete Bridges."* (Mailed free to any point in U. S. or Canada)

*Name*____________________
*Position*____________________
*Address*____________________
*City*______________ *State*__________



The two new boilers generate 45,000 lbs. of steam per hour at 250 lbs. pressure and 406° F., and serve all the state buildings in Colorado's capital with power and hot water for heating. Several miles of tunnels carry heat from the new boiler room to the various state buildings. Steam lines are covered with Carey 85% Magnesia; the hot water lines with Carey Asbestos Sponge Felt.

Installations were made by Denver Plumbing and Heating Company.

COLORADO GETS SURPRISING DEMONSTRATION OF HIGH EFFICIENCY OF Carey HEAT INSULATIONS

WHEN the Colorado State House installed a new steam generating plant recently, the equipment was completely CAREY Insulated — boilers with CAREY Hi-Temp No. 12; steam lines with CAREY 85% Magnesia; hot water lines with CAREY Asbestos Sponge Felt.

These insulations proved so efficient in conserving heat that it was found necessary to install three overhead heating units to heat the boiler room in winter!

Don't gamble when you buy insulations. Make sure of maximum savings in fuel and heat by specifying CAREY Insulations. A nationwide organization is at your service. Send for Insulation Catalog — address Dept. 30.

THE PHILIP CAREY MFG. COMPANY • Lockland, Cincinnati, Ohio
Dependable Products Since 1873
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Miscellaneous Notes on Booklets and Reprints

(*Continued from p. 96*)

1934 are minor to make the specifications conform to present-day practice and to incorporate the latest revisions of cut-back asphalt specifications.

A NEW EDITION of "A.S.T.M. Standards on Cement" has just been issued by the American Society for Testing Materials (260 S. Broad St., Philadelphia, $1.) This 1941 edition contains the recently adopted specifications for portland cement (C 150-41) covering five types, including high early strength, low heat, and high sulfate resistant cements.

DRAINAGE FOR AIRPORT USING CORRUGATED IRON PIPE is the subject of a pamphlet entitled "Airport Drainage," recently prepared by the Armco Drainage Products Association, Middletown, Ohio, for limited distribution to engineers and contractors concerned with the design and construction of airports. Included is a discussion of the hydraulics of airport drainage and numerous charts and tables for use in design of drainage systems.

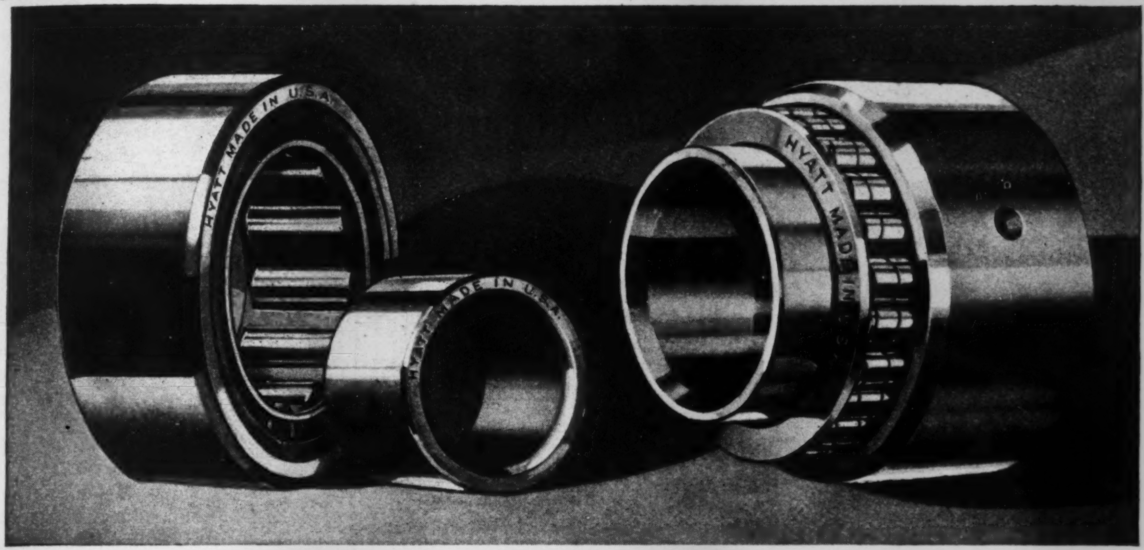
TO HELP ROADBUILDERS in the British Isles meet some of the peculiar problems growing out of the war, the Road Research Laboratory of the British Department of Scientific and Industrial Research has begun the publication of special reports, the first of which appears under the title of "Wartime Road Note No. 1—Recommendations for Tar Carpets and Surface Dressings." (His Majesty's Stationery Office, London; 6d.) The purpose of this pamphlet is to facilitate the greatest possible use of local materials, thus cutting down the demands on transport and speeding road and airport construction or reconstruction.

New Engineering Books

INDUSTRIAL ACCIDENT PREVENTION—Second Edition. By H. W. Heinrich. 448 pp. McGraw-Hill Book Co., New York and London. Price $3.

(*Continued on p.* 113)

KEEP THEM YOUNG WITH HYATTS


HYATT MADE IN U.S.A.
HYATT MADE IN U.S.A.
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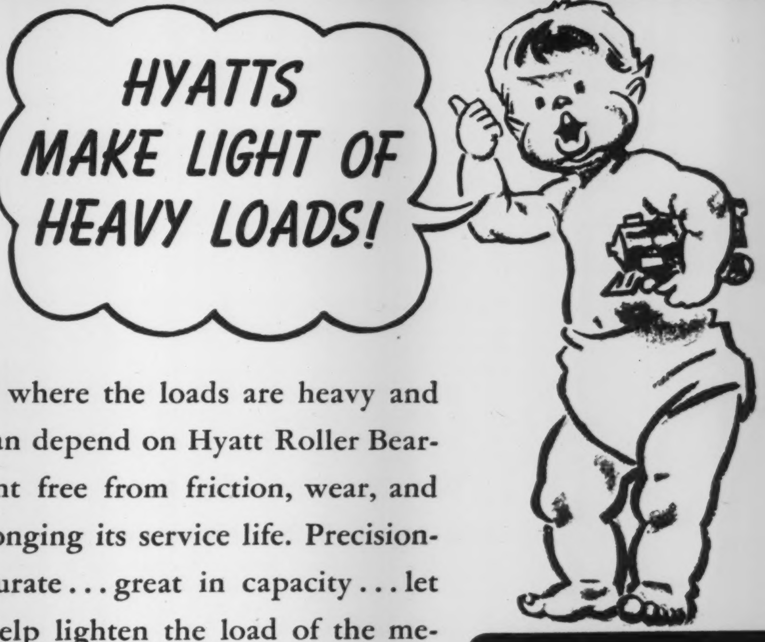
NO MATTER WHAT THE APPLICATION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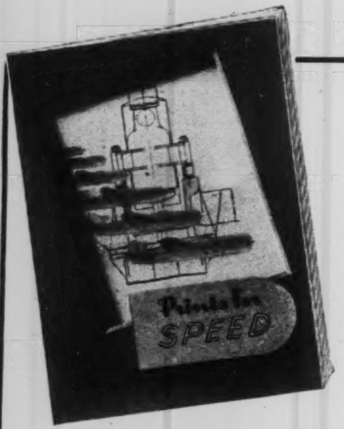

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MEN AND JOBS

H. S. Thomas, engineer of construction of the Seaboard Air Line Railway System, Norfolk, Va., has retired from active duty. Mr. Thomas has been connected with the Seaboard System for a period of 38 years and has been in charge of the location and construction of many of the lines and extensions of the railway system.

G. H. Richards has been appointed city engineer of Brantford, Ontario. For the past few months he has been Maritime Engineer for Wartime Housing Limited, Canada's defense housing organization, and previously to that had been for many years on the staff of Lee and Nash, consulting engineers of Brantford specializing in municipal work. Mr. Richards succeeds **E. T. McLaren** who was appointed only about one month ago to succeed the late Frank P. Adams, as city engineer. Mr. MacLaren was forced by ill-health to tender his resignation after only one month in office.

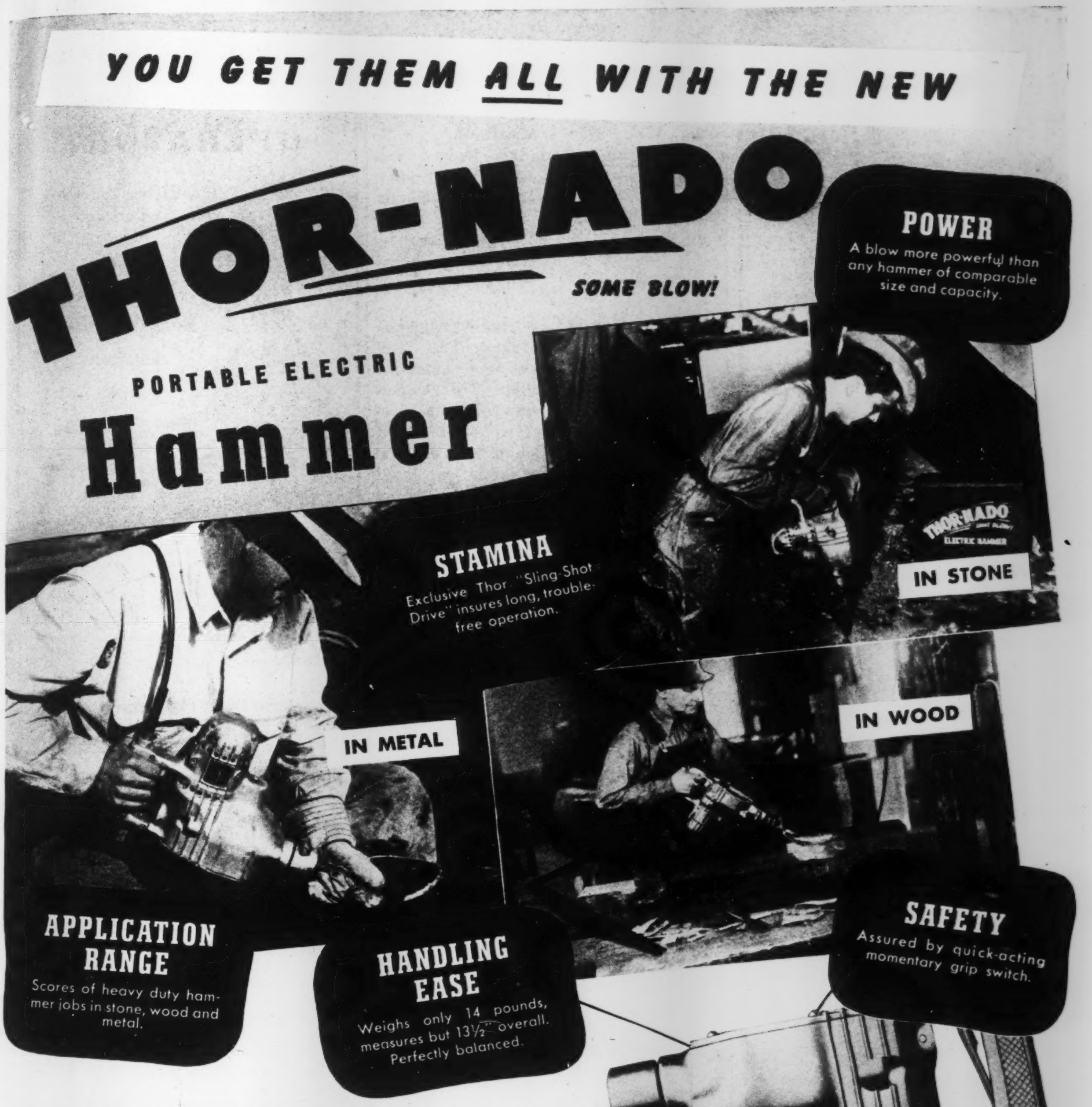
Pennsylvania's department of highways has announced the appointment of **Thomas J. Hughes,** of Claysville, Pa., as a project engineer assigned to District No. 12, with headquarters at Uniontown.

Harry P. Hart, senior highway engineer, Public Roads Administration, who has been in Ecuador for two years as an adviser to the Equadorian government (principally on parts of the Pan-American highway system) recently returned to the United States on completion of his South American duty. He is now en route to Bolivia, again "on loan" from the State Department, this time to advise the Bolivian government, for an 8 months' period, on the development of the Bolivian highway system.

J. G. Caron, has been appointed member of the new Board of Revision at the City Hall of Montreal. He had been assistant director of public works for the past year, and previously for eight years, superintendent of the technical division of the Public Works Department. He has had about twenty-five years of service at the City Hall.

C. J. LeBlanc has been appointed engineer attached to the office of the Director of Public Works at the City Hall of Montreal. A graduate of the Ecole Polytechnique of the class of 1910, he has been with the city since 1912. His previous position was that of assistant director of public works.

(*Continued on p.* 108)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A blow more powerful than any hammer of comparable size and capacity.
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Exclusive Thor "Sling-Shot Drive" insures long, trouble-free operation.
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Weighs only 14 pounds, measures but 13½" overall. Perfectly balanced.
SAFETY
Assured by quick-acting momentary grip switch.

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These factors, plus the Thor-Nado's unusual safety, top notch materials and workmanship, and wide range of application, are the reasons why more than 3 thousand construction and maintenance men have chosen the Thor-Nado. In stone, wood, and metal it's given them fast, accurate results on such operations as hole drilling, demolition, chipping, channeling, cutting, and gouging.

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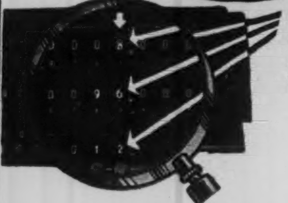

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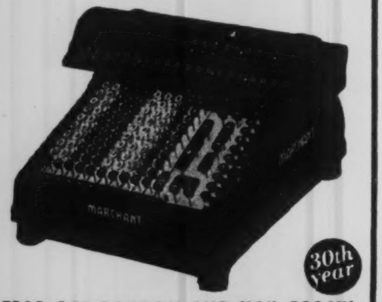

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(*Continued from p. 106*)

Harvey B. Armour, state director of the operations division of WPA in Iowa since 1935, has been promoted to the position of regional engineer in the St. Paul, Minn., office. Mr. Harvey, for 17 years a resident of Des Moines, was with the Iowa civil works administration and the state emergency relief administration as program engineer before joining WPA. He will be succeeded by **A. E Mitchell** as director of the operations division.

Chris J. Sherlock, director, Alabama state highway department, has been nominated president of the American Road Builders Association. The nomination is considered tantamount to election, and Mr. Sherlock will be installed at the 1942 convention of the association in Memphis, Tenn., the week of March 2. He succeeds **Hal G. Sours,** director, Ohio Department of Highways. He was also recently elected vice-president of the American Association of State Highway Officials.

Effective No. 1, **Douglas G. Wright** became acting chief of PWA's power division, replacing **K. S. Wingfield,** who has resigned to enter private practice in Washington, D. C. Mr. Wright has been assistant director of the power division since 1934. He has been with PWA since its inception and for some time was chief project engineer in Nebraska on all power and irrigation projects.

Fred H. Nichols has been transferred from investigations work for the Bureau of Reclamation in the vicinity of Boise, Idaho, to similar work in the Rogue River basin, with headquarters at Grants Pass, Ore. A list of Mr. Nichols' previous investigations includes work on the Pecos, Gila and Humboldt rivers; Boulder Dam, Taylor Park Dam (the Bureau's highest earthfill dam); and project investigations in several northwestern states, of which the most recent was the Mountain Home project near Boise. At Grants Pass he succeeds **D. M. Forester,** who has been assigned to the Denver office.

Arthur C. Kruzweil is now assistant professor of civil engineering in the University of Maryland. Formerly he was an industrial engineer with Consolidated Aircraft Corp. at San Diego, Calif. In the past he has been connected with the University of Minnesota, Marin Junior College and General Motors Corp.

William B. Gilbert, Deschutes County engineer at Bend, Ore., for the past year, has resigned to enter private business. He had been on the county staff for many years.

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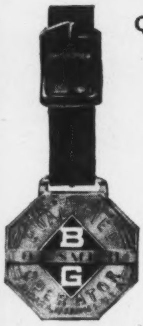

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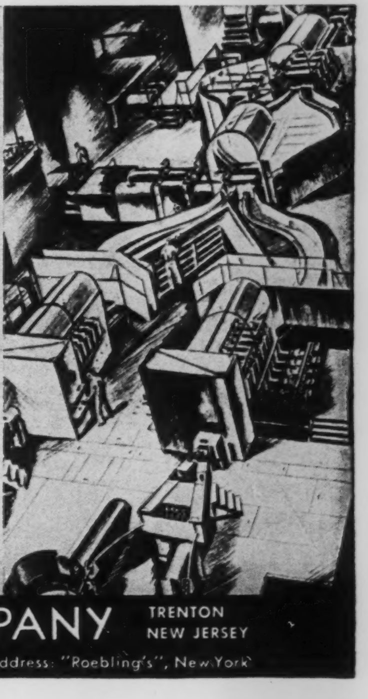

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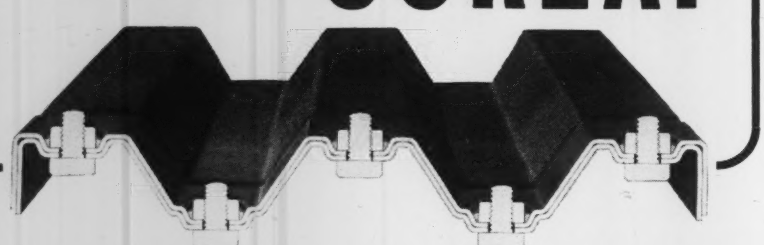

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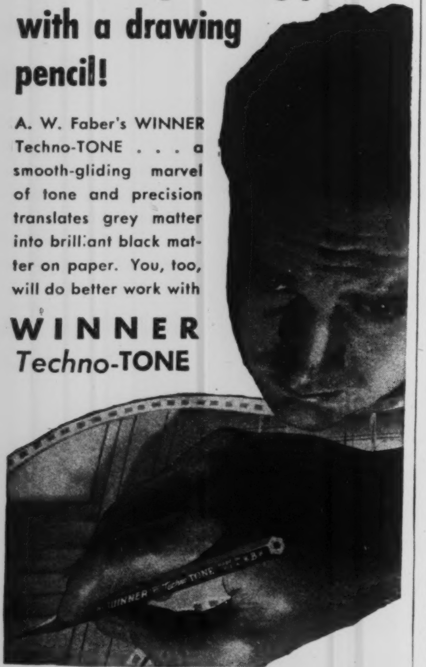

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MEETINGS

HIGHWAY RESEARCH BOARD, 21st annual meeting, Johns Hopkins University, Baltimore, Md., Dec. 2–5.

AMERICAN SOCIETY OF CIVIL ENGINEERS, annual meeting, New York, N. Y., Jan. 21–23, 1942.

NATIONAL SAND & GRAVEL ASSN., 26th annual convention, Netherland Plaza Hotel, Cincinnati, Ohio, Jan. 28–30, 1942.

REGIONAL AND LOCAL MEETINGS

ILLINOIS SEWAGE TREATMENT OPERATORS CONFERENCE, 7th annual meeting, Springfield, Ill., Dec. 2–3.

ILLINOIS ASSOCIATION OF COUNTY SUPERINTENDENTS of Highways and City Engineers, state meeting, Springfield, Ill., Dec. 3.

ASSOCIATED GENERAL CONTRACTORS OF AMERICA, New York State Highway Chapter, Inc., annual convention, Hotel Syracuse, Syracuse, N. Y., Dec. 3–4.

NORTH CAROLINA ASSOCIATION OF PLUMBING AND HEATING CONTRACTORS, winter convention, Washington Duke Hotel, Durham, N. C., Dec. 4–5.

NEBRASKA IRRIGATION ASSOCIATION, annual convention, Kearney, Neb., Dec. 8–9.

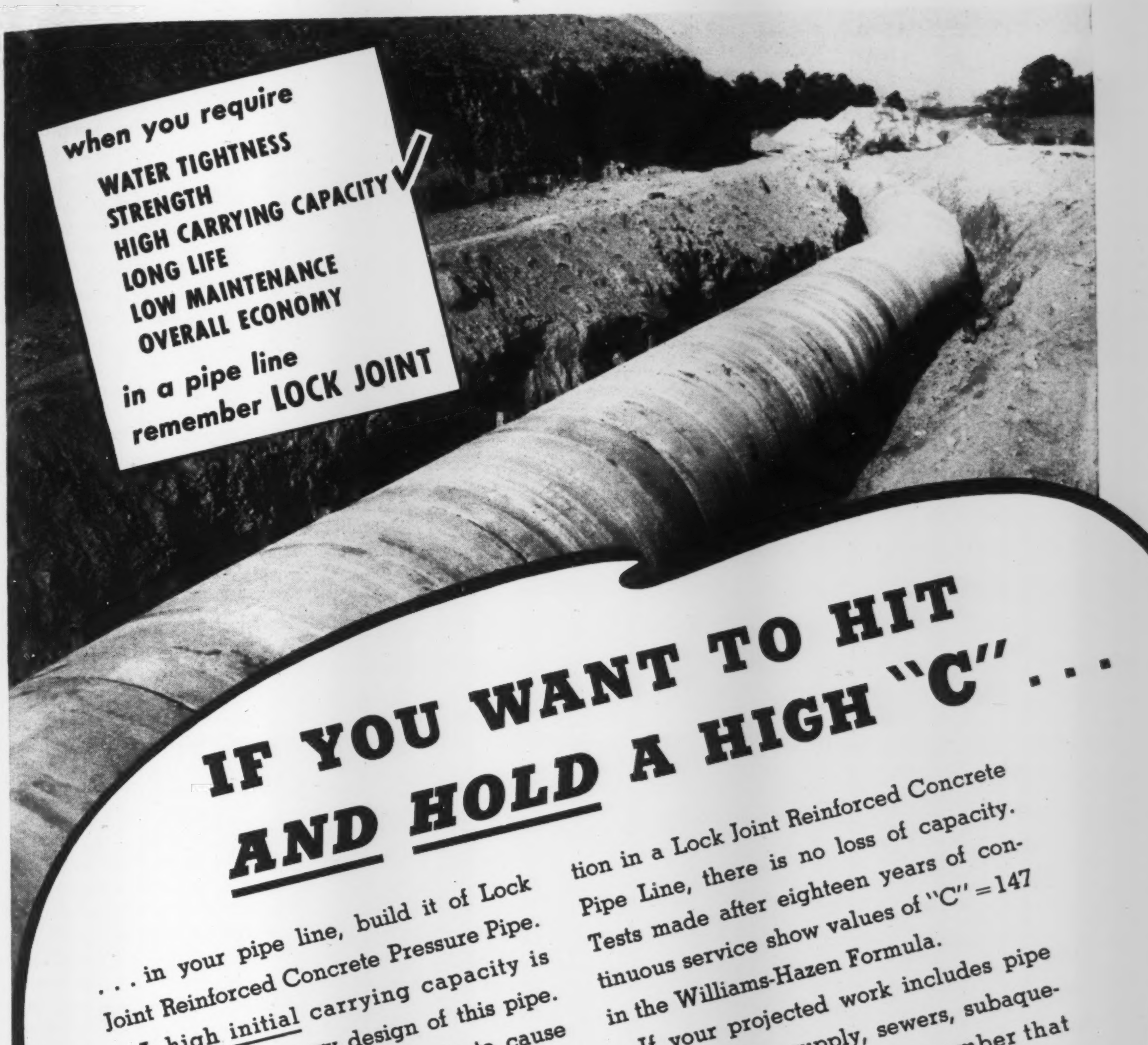
CAROLINAS BRANCH, AMERICAN GENERAL CONTRACTORS, 21st annual convention, Sir Walter Hotel, Raleigh, N. C., Dec. 11–12.

ILLINOIS CONTRACTORS ASSOCIATION, annual meeting, Hotel Abraham Lincoln, Springfield, Ill., Jan. 7–8, 1942.

ELECTIONS AND ACTIVITIES

LT. COL. READING WILKINSON, U. S. District Engineer at Charleston, S. C., was re-elected president of the Charleston Post, Society of American Military Engineers, at its annual meeting October 15. Other officers are: James E. Gibson, superintendent and engineer for the Charleston waterworks, first vice president; Leroy F. Harza, president of the Harza Engineering company, second vice president; Walter M. Bell, secretary; Lieut. Walter M. Noland, treasurer; Lieut. Daniel F. Fishburne, assistant treasurer; and John McCradym, E. David Jeever and Lt. Comdr. Harry H. Schoen, directors.

THE OPENING MEETING of the winter session of the Toronto Branch of the Engineering Institute of Canada was held on October 16, and was featured by the presence, as guests of the Branch, of fifteen distinguished Polish engineers.



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These men, mostly experts in aeronautical engineering, managed to escape from Poland after its invasion in various ways, and are now in Canada engaged on essential work in Canadian industrial plants engaged on war work. With fellow Polish engineers in Canada they have formed the Association of Polish Engineers in Canada. One of their number delivered a paper to the meeting (in almost perfect English) on "Plastic Moulded Wood in Aircraft Construction." A special welcome was extended by chairman H. E. Brandon to Dean C. R. Young, of the University of Toronto, a former chairman of the Branch.

THE STRUCTURAL ENGINEERS ASSN. of California held its tenth annual convention at Monterey, Oct. 10-11 with representative men present in about equal numbers from Los Angeles and San Francisco Bay region. Foundation problems, prefabricated concrete, modification of building codes, availability of basic construction materials and post-war reconstruction and rehabilitation were some of the principal topics.

THE TWENTY-SIXTH ANNUAL MEETING of the Canadian Good Roads Association was held in Niagara Falls, Ontario, on October 9-10 with an attendance of over 500. Hon. J. P. McIntyre, Minister of Public Works and Highways for the province of Prince Edward Island was elected President for the coming year. The main resolution passed at the final session called attention to road building as a necessary part of post war planning, urging its value in this respect in view of the large amount of labor involved, and suggested that the Dominion Government should be interested in this work (even though road building is normally a provincial responsibility).

AN ORGANIZATION REPRESENTING all branches of the building industry in Milwaukee, Wis., has been organized with the purpose of working out plans to prevent collapse of the building industry in the face of the defense program and priorities on materials. A special committee was named to study and report on ways and means of remedying the situation. The committee consists of Leigh Hunt, representing the architects; Peter T. Schoemann, labor; Arthur A. Ornst, employers; Louis Schmaus, master plumbers; W. H. Oleson, heating, piping and air conditioning contractors, and W. T. Dortch, Producers' Council. S. H. Eigel of the Associated General Contractors was elected secretary.

MORE THAN ONE HUNDRED delegates attended the 26th annual meeting of the Missouri Valley Section of the American Waterworks Association, held at Cedar Rapids, Iowa on Oct. 20.

New Engineering Books

(Continued from p. 104)

PREVENTION OF THE FAILURE OF METALS UNDER REPEATED STRESS—A handbook prepared for the Bureau of Aeronautics by the staff of Battelle Memorial Institute. 277 pp. John Wiley & Sons, New York; Chapman & Hall, London. Price $2.75.

TRAFFIC ENGINEERING HANDBOOK—Contributions by fourteen authors compiled and edited by Harold F. Hammond and Leslie J. Sorenson. 285 pp. Institute of Traffic Engineers and National Conservation Bureau, 60 John St., New York. Price $3.25.

MUNICIPAL AFFAIRS—By Ernest W. Steel. 389 pp. International Textbook Co., Scranton, Pa. Price $3.50.

AN INTRODUCTION TO THE OPERATIONAL CALCULUS—By Walter J. Seeley. 167 pp. International Textbook Co., Scranton, Pa. Price $2.

BOULDER CANYON PROJECT FINAL REPORTS—Part IV—Design and Construction. Bulletin 1, General Features; Bulletin 2, Boulder Dam. Published by the Bureau of Reclamation. May be obtained from the Bureau, Washington, D. C., or Denver, Colo. Price paper-bound, $1.50; cloth-bound, $2, each bulletin.

HIGHER MATHEMATICS FOR ENGINEERS AND PHYSICISTS—Second Edition. By Ivan S. Sokolnikoff and Elizabeth S. Sokolnikoff. 446 pp. McGraw-Hill Book Co., New York and London. Price $4.50.

Reports and Pamphlets

FURTHER CARTOGRAPHIC STUDIES OF DROUGHT—By W. R. Baldwin-Wiseman. Reprint from the *Quarterly Journal* of the Royal Meteorological Society, 49, Cromwell Road, South Kensington, London, S.W. 7, England.

FIRE ENGINEERING HYDRAULICS—Emmott & Co., Ltd., 78, Palatine Road, Manchester, 20, England. Price 1/0.

CHARLESTON, S. C.—Twenty-fourth annual report of the Commissioners of Public Works, Water Department.

PUBLIC WATER SUPPLIES AND CONTROL OF STREAM POLLUTION IN OHIO—Circular No. 41. Ohio State University, Engineering Experiment Station, Columbus, Ohio.

STREAM FLOW RECORDS OF PENNSYLVANIA—1940—Dept. of Forests and Waters, Division of Hydrography, Harrisburg, Pa.

ST. FRANCIS LEVEE DISTRICT OF ARKANSAS—Annual Reports of Officers. 1941.

CONNECTICUT SOCIETY OF CIVIL ENGINEERS—Annual Report, 1941.

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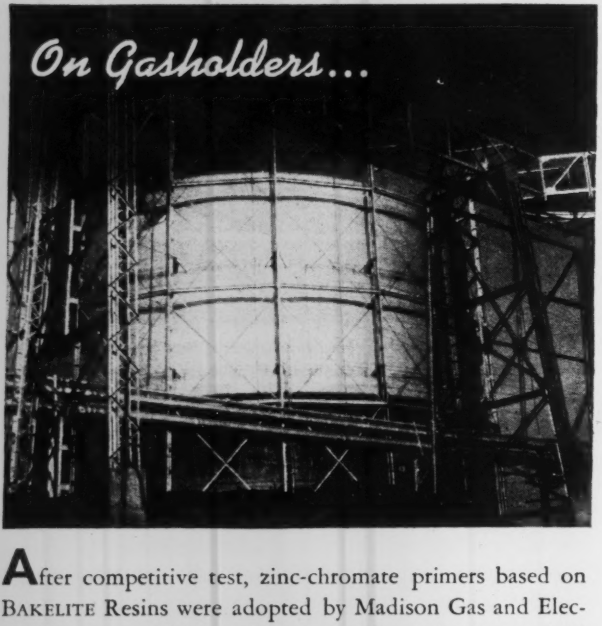
DERRICKS • WINCHES • SHEAVES

For Paint Specifications that Assure Maximum Surface Protection

ENLIST THE AID OF BAKELITE LABORATORIES



After competitive test, zinc-chromate primers based on BAKELITE Resins were adopted by Madison Gas and Electric Company, Madison, Wisconsin, for gasholders and all metal structures. The greater resistance of these finishes to industrial fumes, smoke, fly ash, and other deteriorating factors is still further demonstrated by many similar applications the country over.

WHEREVER service conditions are exceptionally severe...on locks and dams, on bridges, on storage tanks, and other outdoor structures . . . you can obtain greater durability in the coatings you specify when they are fortified with BAKELITE Resins.

Coatings based on BAKELITE Resins are highly resistant to industrial smoke, moisture, abrasion, and to temperature extremes. From Texas to Maine, from California to Florida, they are meeting the most stringent government and industrial specifications.

Bakelite Laboratories will be glad to assist you in developing paint formulations to meet your particular needs. Also, write for Booklet 11S, "Bakelite Synthetic Resins," and Bulletin 17, "Specifications for BAKELITE Resin Finishes."

BAKELITE CORPORATION, 30 EAST 42ND ST., NEW YORK
Unit of Union Carbide and Carbon Corporation

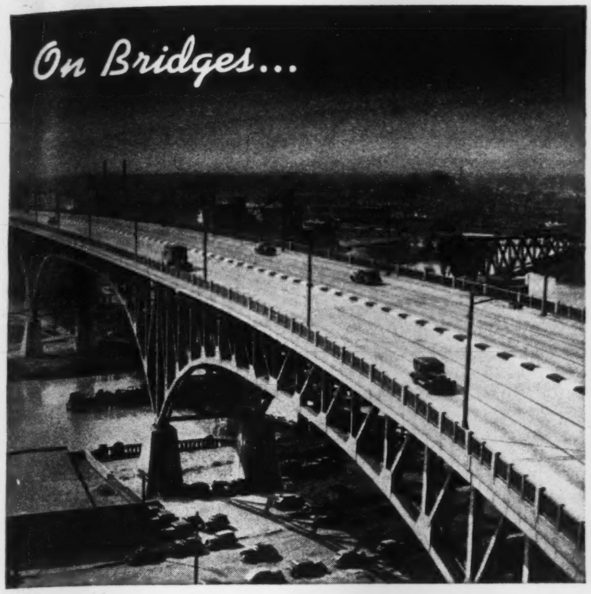
UCC

BAKELITE
TRADE-MARKS

The word "Bakelite" and the identifying products B ∞ Symbol are registered trade-marks of Bakelite Corporation

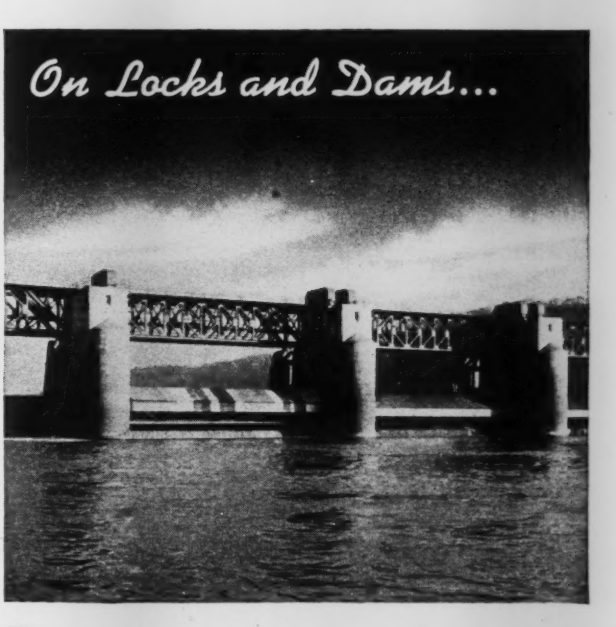
Resins for Protective Coatings

On Bridges...



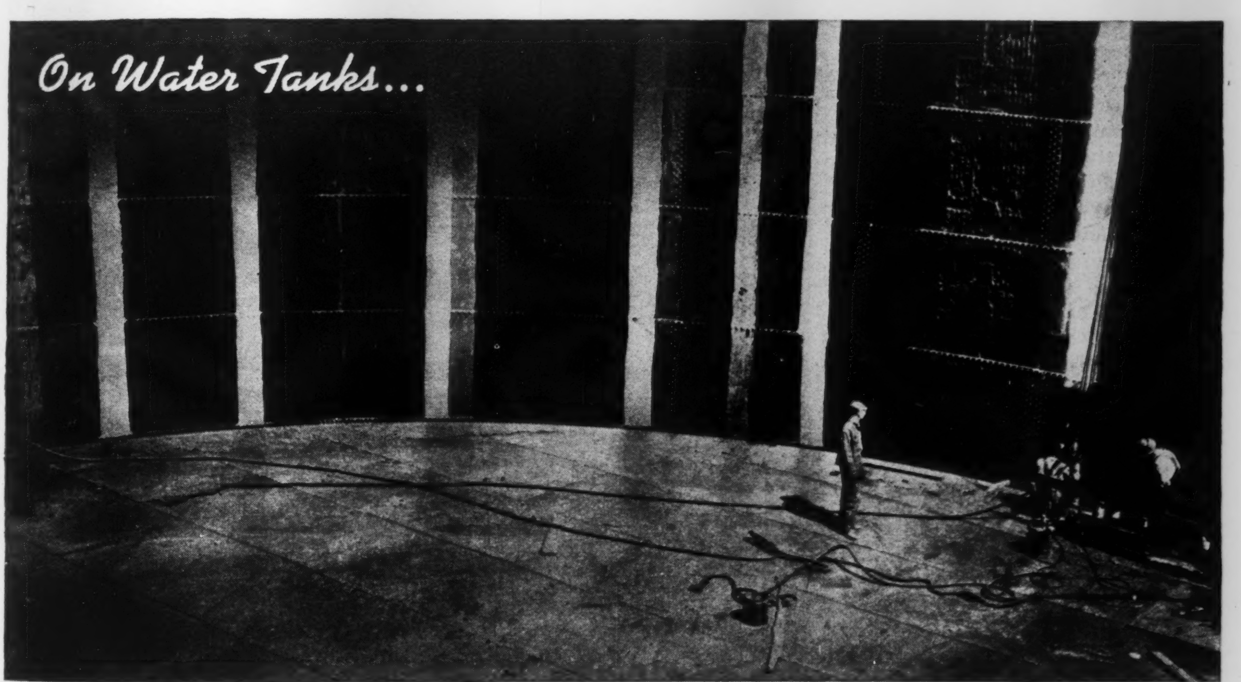
"Specifications for the paint used on all the structural steel of the Main Avenue Bridge in Cleveland were designed to assure maximum durability, adhesion, and impermeability of the film," says J. O. McWilliams, County Engineer. These characteristics were obtained by applying two shop coats and field coats, all based on BAKELITE Resins.

On Locks and Dams...



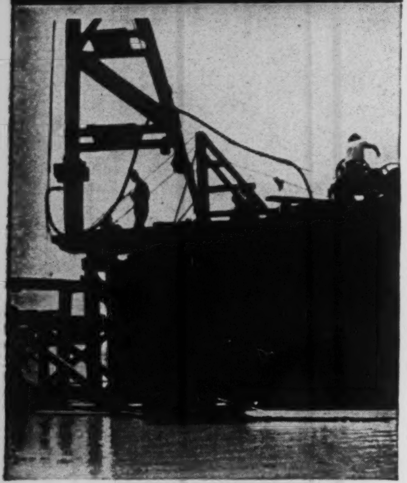
Protective coatings on dam locks and gates are subjected not only to submersion in rapidly moving water, but also to abrasion from silt, floating debris, and ice jams. Compared with paints formerly used, which failed within two or three months, finishes based on BAKELITE Resins are still in good condition after years of service.

On Water Tanks...



Convincing evidence of the outstanding water resistance of coatings based on BAKELITE Resins is provided by tests conducted for the Borough of Ambridge, Pennsylvania, on the interior of this 1,000,000-gallon water tank. One hundred ninety-six sections of the tank interior were painted with an extremely wide range of competitive coatings. After 16 months immersion, a section coated with a BAKELITE Resin Finish was the only one rated 100 per cent by inspectors of the Pittsburgh-Des Moines Steel Corporation.

It Tamed a Raging River



Engineers worked fast when rising waters broke through levees to flood 35,000 acres of rich farm land in the Sacramento River valley. Using ARMCO sheeting they repaired the breaks, brought order out of chaos, and at the same time laid the groundwork to prevent a repetition of the disaster.

A closure structure was erected, using a timber and pile bulkhead faced with sturdy ARMCO Corrugated Sheeting. This afforded immediate relief and served as the core wall for a new permanent levee.

Emergencies like this one are unusual, yet there are many regular jobs that you can do exceedingly well with ARMCO Sheeting. Use it for trenches, cofferdams, foundations and similar projects. You'll find it low in cost, amply strong yet light in weight and easy to handle. It drives fast and can be used again and again.

ARMCO Corrugated Sheeting is available in three designs to meet various job requirements. Write for more information regarding its many practical advantages. ARMCO DRAINAGE PRODUCTS ASSOCIATION, 5058 Curtis Street, Middletown, Ohio.

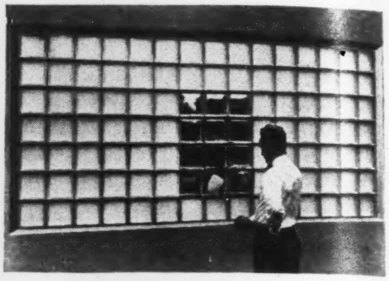
ARMCO
ARMCO SHEETING

New Aids to the Constructor

Equipment and material announcements and manufacturers' news

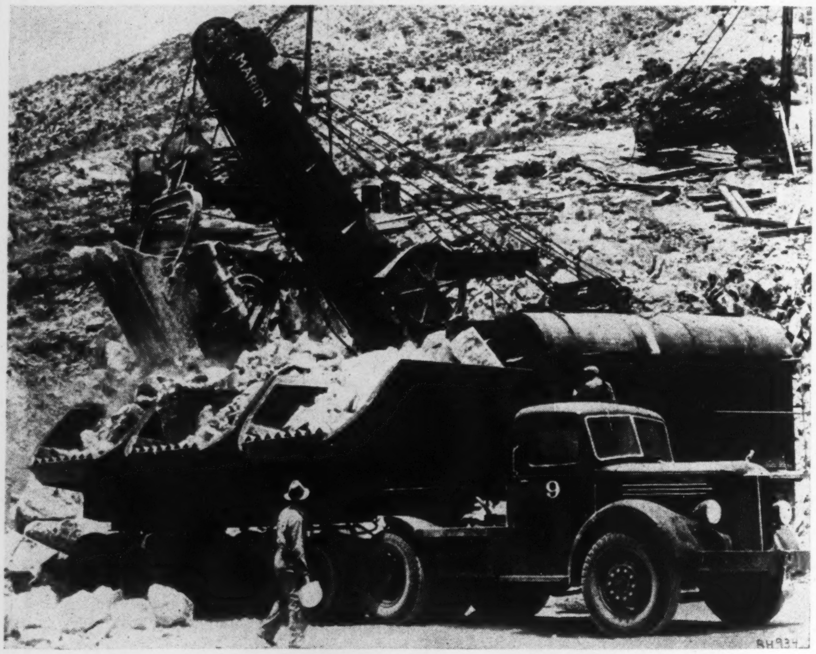
Welding Protection

Complete protection against heat or excessive current, or both, is provided by a new protective control device which consists of two current transformers the primaries of which are connected in series with the motor leads and the secondaries supplying power to operate two snap-action thermostats which are mounted directly on the motor lamination. These thermostats are connected to the lamination in such a way that they operate by means of heat conduction, as well as by current passing through the thermostat. The thermostats automatically reset when the motor returns to a safe operating temperature or when the current is reduced. No manual operation is required to start the machine, except pushing the start button.—*The Lincoln Electric Co., 12818 Coit Road, Cleveland, Ohio.*



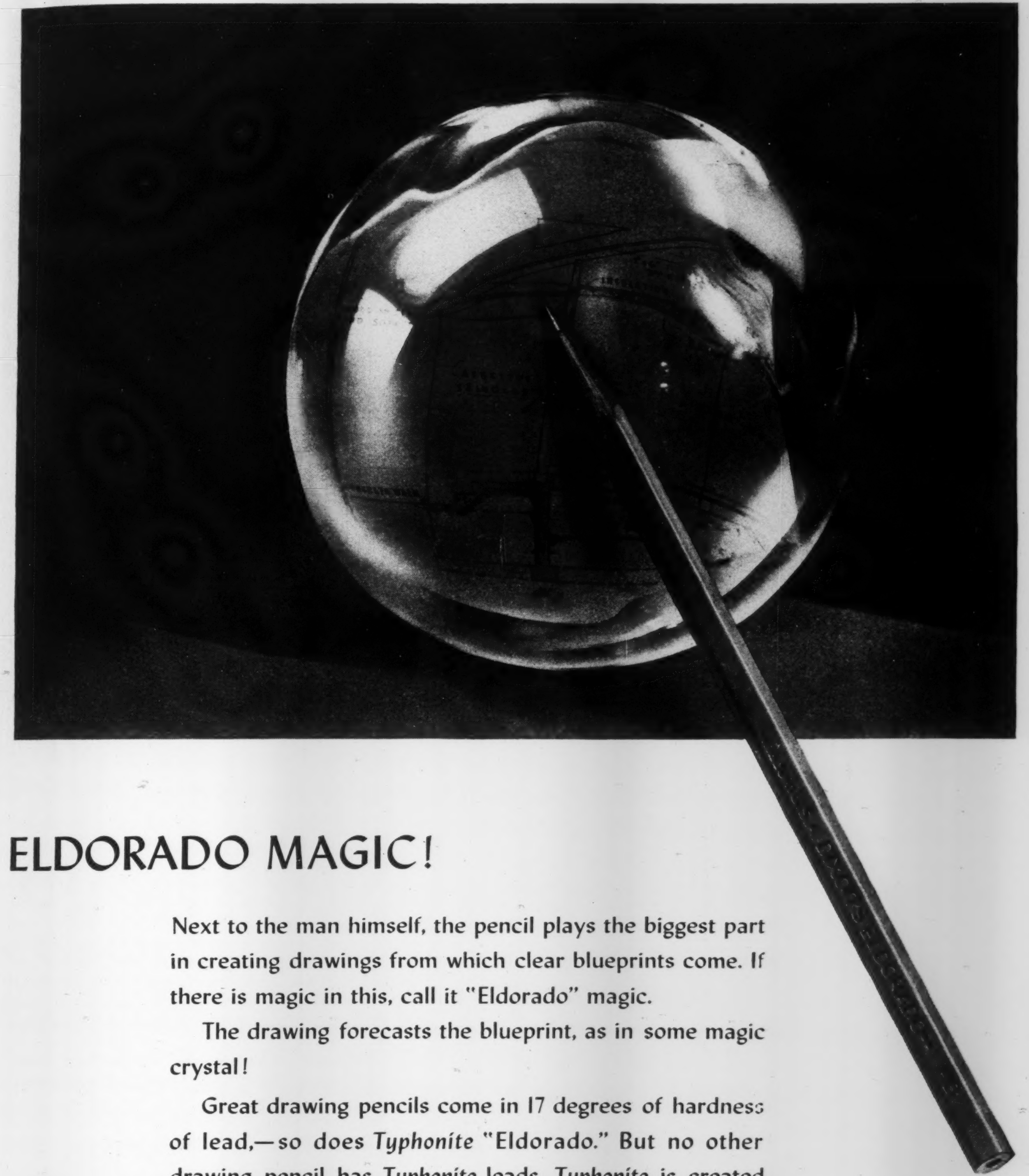
Transparent Building Block

Recently announced is the development of a transparent glass building block that affords almost window-like vision. The new block, called the "Vue" glass block, was developed for specific needs where some outside vision is desired through panels of non-transparent glass blocks. General vision of large



Triple-Side-Dump Truck

The heavy-duty rock dump units shown above are made up of three 8-yd. side-dump bodies 7 ft. wide inside, 45 in. high, and 10 ft. 6 in. long. The bodies are mounted on a semi-trailer and are equipped with ST-94, 30½ in. Heil telescopic hoists. The hoists can be operated independently or two at one time. One pump for operation of all three hoists is operated by the driver from the cab, while a dumping valve for each hoist at a level with the trailer permits dumping by the quarry man at the siding. Dumping time per body is 30 sec. A Model LMSW Mack tractor, six-wheel, four-wheel drive, powers the unit, which is in operation at the Southwestern Portland Cement Co.'s plant at Victorville, Calif. —*Truck information from Mack International Motor Truck Co., Long Island City, N. Y. Body information from Heil Co., Milwaukee, Wis.*



ELDORADO MAGIC!

Next to the man himself, the pencil plays the biggest part in creating drawings from which clear blueprints come. If there is magic in this, call it "Eldorado" magic.

The drawing forecasts the blueprint, as in some magic crystal!

Great drawing pencils come in 17 degrees of hardness of lead,—so does *Typhonite* "Eldorado." But no other drawing pencil has *Typhonite* leads. *Typhonite* is created in a literal whirlwind from natural graphite. There is no stopping the whirlwind and there is no stopping Dixon *Typhonite* "Eldorado" as it whirls along far in the lead.

TYPHONITE ELDORADO

PENCIL SALES DEPARTMENT 227-J112 JOSEPH DIXON CRUCIBLE CO. • JERSEY CITY, N. J.

TRY *Columbia*

TRACING CLOTH

Here is the latest innovation in TRACING CLOTH containing all of the fine qualities which the most expert draftsman desires. Tested and proven in quality for surface efficiency. Cleans easily. Corrections of ink or pencil made easily, but the superiority of this NEW Tracing Cloth is best proven by use and you are urged to send for a large working sample sheet. We shall abide by your decision.

THE *Columbia* MILLS
INCORPORATED
225 FIFTH AVENUE
NEW YORK, N. Y.

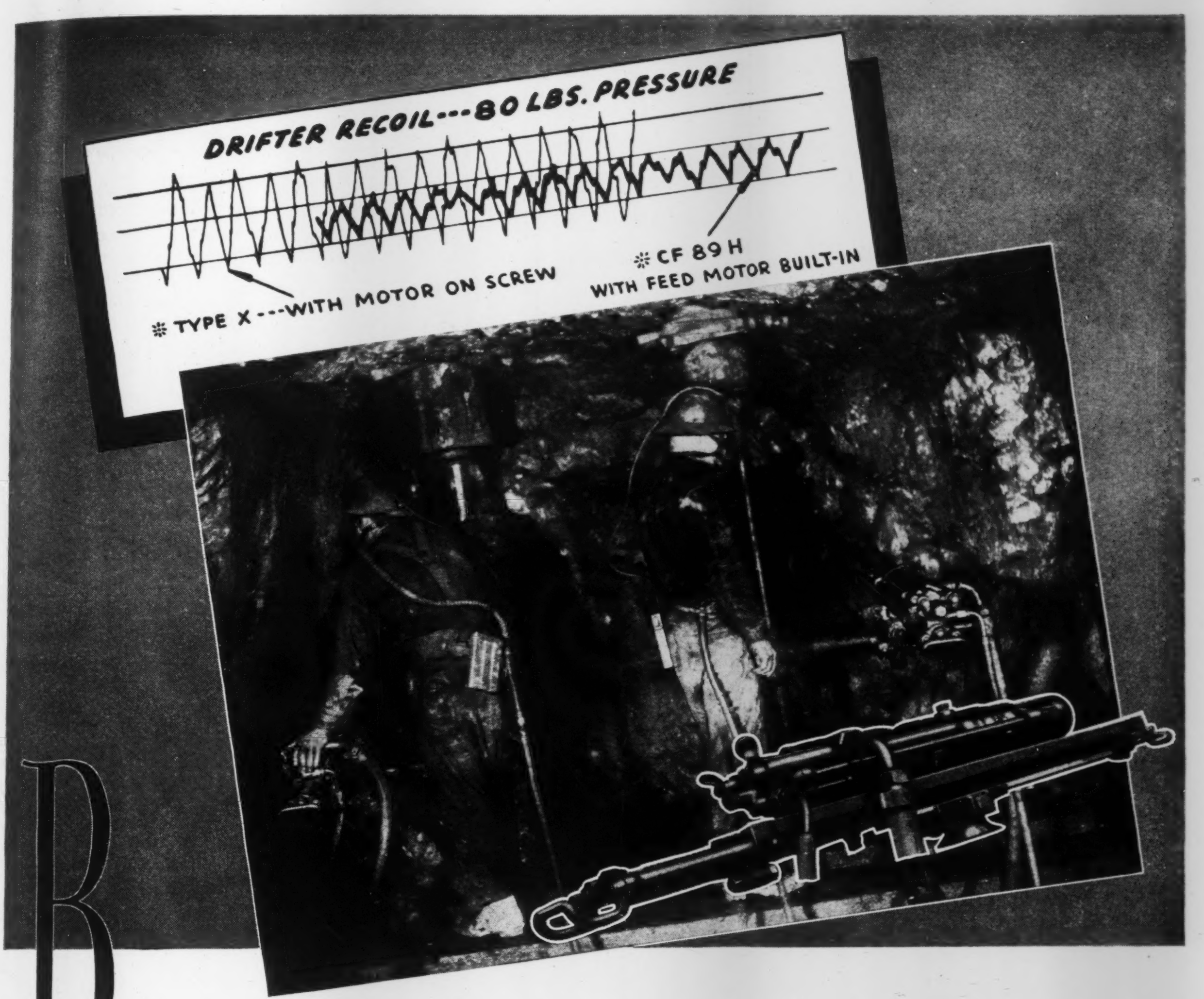
objects or movements beyond the panel prevent a "shut-in" feeling, although the visibility of sharp detail is not possible under most conditions. The "Vue" block has the high insulation properties of the usual glass block. It contains a partial vacuum, a dead air space, and has more than twice the insulation value of the ordinary single-glazed windows.—*Pittsburgh Corning Corp., Grant Building, Pittsburgh, Pa.*

1¼-Yard Shovel

The newly developed Osgood Type 70 excavator and material handler is available with either conventional crawler mounting or as a Mobilcrane with pneumatic tired wheel mounting. Rated as a 1¼-yd. shovel or a 15-ton crane, it can perform the duties of a shovel, dragline, clamshell, crane, etc. It has a unit cast steel deck which gives a stronger base for machinery, and lessens vibration; is controlled throughout by air (except hoist drum brakes); its swing, travel and retract motions are controlled by use of Twin Disc Clutches, it has the ability to lower heavy loads against the friction of the operating machinery and the compression of the engine; it may be steered in any direction without stopping the forward motion of the machine; and it may be supplied with independent travel mechanism and independent boom hoist. —*The Osgood Co., Marion, Ohio.*

Flashlight

Rub-R-Lite, the new patented rubber flashlight that can be dropped several stories or left under water for months without damage, enters the national market this month in two-cell and three-cell sizes, in either focusing or fixed-focus types. A special two-button snap switch does away with the common switch problem, while the patented inside battery case prevents corroded batteries from being permanently stuck, and an aluminum plated reflector with a shatterproof, plastic lens, throws a clean, pow-


DRIFTER RECOIL---80 LBS. PRESSURE
※ TYPE X---WITH MOTOR ON SCREW
※ CF 89 H WITH FEED MOTOR BUILT-IN

BACKGROUND FOR BETTER PERFORMANCE

● This recoil test chart shows why users are getting better performance from Gardner-Denver CF89H Continuous Feed Drifters. Notice how the *built-in* feed motor dampens vibration—how the additional weight of the motor aids in absorbing recoil.

Exceptionally smooth action, greater drilling speed and increased dependability—those are the big reasons why the Gardner-Denver Continuous Feed Drifter is getting such an enthusiastic reception in tunnel driving and mining operations in many parts of the world.

Let us send you descriptive bulletins on the Gardner-Denver CF89H Continuous Feed Drifter. Write Gardner-Denver Company, Quincy, Illinois.

HERE ARE ADDITIONAL FEATURES WHICH ARE WINNING USER APPROVAL FOR CF89H

1. **Long life and low air consumption due to a powerful slowly moving piston-type feed motor.**
2. **Directions of feed, as well as power and speed, fully controlled by feed throttle.**
3. **Controls conveniently located in drill back-head.**
4. **Higher drilling efficiency assured because drill is always held in proper relation to the shank.**

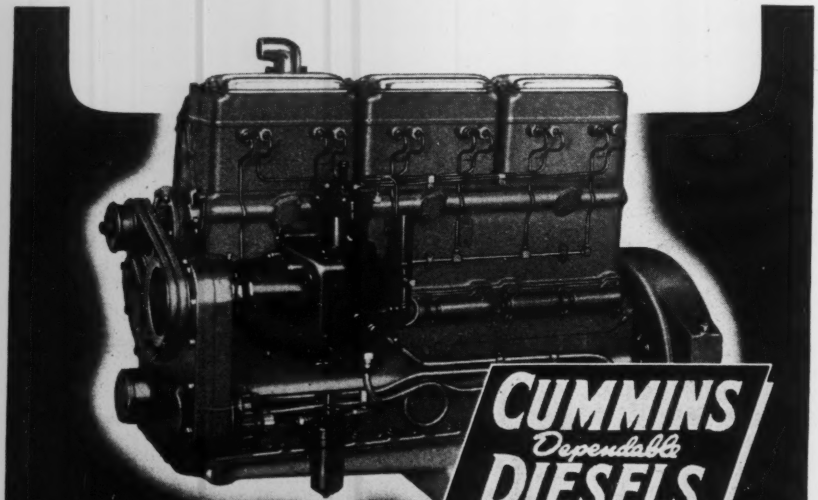
GARDNER-DENVER

Since 1859

HOW MANY WORK HOURS
in Your Cummins Diesels?

That's strictly up to you. Many Cummins Dependable Diesels in heavy-duty construction equipment have proved they will deliver low-cost, reliable service indefinitely by observing routine maintenance practices. Your Cummins Diesels will do the same if you give them a chance . . . don't neglect them. Your Cummins dealer in cooperation with the manufacturer of the complete unit—*better than anyone else*—can tell you how to maintain your Cummins Diesels at the lowest cost. He carries a complete stock of *genuine* Cummins parts. He has expert mechanics. He has authentic, up-to-the-minute maintenance and service information. He is equipped in every way to increase the efficient operating life of your Cummins Dependable Diesels and these facilities are at your disposal at all times. Remember, *every* Cummins dealer is *your* Cummins dealer. He is always ready and able to serve you, regardless of time or place. Cummins Engine Company, Columbus, Ind.

ILLUSTRATED: *Model HBI-600 Cummins Dependable Diesel. 150 hp. at 1800 rpm.*

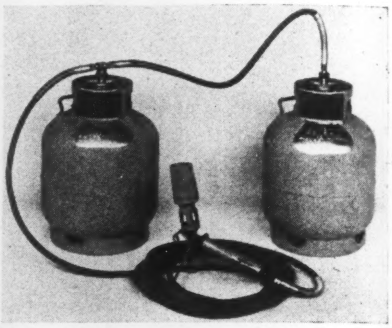


CUMMINS *Dependable* DIESELS

erful long-range spot. The light is completely insulated and is safe for working around electric wires.—*William M. Lennen, Inc., Pasadena, Calif.*

Air-Conditioning Compressor

Worthington has developed a centrifugal compressor of the volute design as opposed to the diffuser design that has heretofore been used in the centrifugal refrigeration field, for use in liquid cooling systems for air conditioning and industrial process requirements. Many new and unusual features are incorporated in this design, notably dual lubrication, balancing of end thrust and side thrust by arrangement of impellers and volutes. These systems are available in a wide variety of sizes covering a range from approximately 150 tons refrigerating effect to 1200 tons refrigerating effect.—*Worthington Pump and Machinery Corp., Harrison, N. J.*



Heating Torch

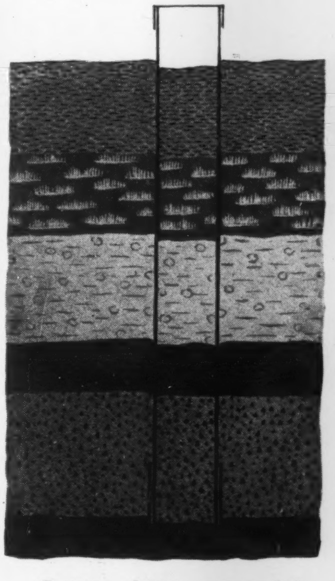
A new heavy-duty Insto-Gas Torch, which produces an amazing amount of heat, is now offered industry. The flame of this new super torch ranges from 6 in. to 24 in. in length, and is shown above connected to two No. 18 cylinders with a tandem hose connector and 25 ft. of hose, which makes an ideal outfit for maintenance work where large quantities of heat are required quickly. The fuel used is propane, the lightest and most volatile produced in the manufacture of gasoline, being composed of two parts carbon and eight parts hydrogen.—*Available from Insto-Gas Corp., 1900 E. Jefferson Ave., with a nation-wide refill service available on the gas containers.*

Valve Grinders

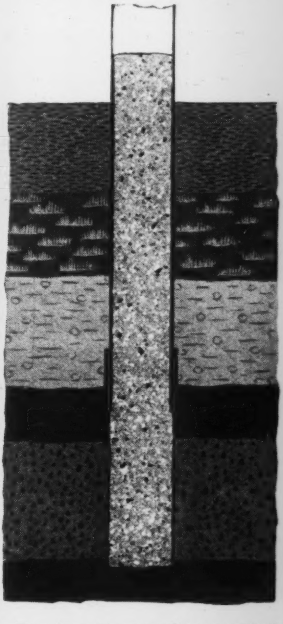
A revolutionary valve reseating tool which cleans, grinds and polishes the valve seat, removing the old disc residue, and all seat defects, is available in eight sizes for valves from ½ to 3 in. The device fits renewable composition and flat seat globe, angle and check valves. All that is necessary to renew the valve is to unscrew the bonnet and remove the pin from the valve body and

BIG BROTHER
OF THE UNCASED CONCRETE PILE

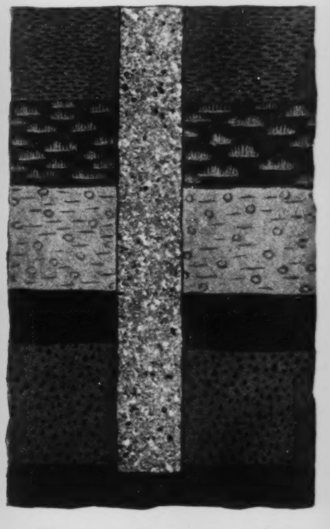
Because we use heavier and more powerful equipment, we now drive and pull 36-inch casings as easily as the customary 14-inch. To depths in excess of 60 feet. Single piles to carry up to 800,000 lbs. load.



Casings driven open-ended on widely spaced centers, so no possible disturbance of adjacent piles can occur.



Concrete is poured to a point well above cut-off so bottom concrete is subjected to considerable pressure.



The cost of permanent lagging or sheeting is eliminated with no loss of safety in the design.

36-INCH CAISSON PILES
SAVE MONEY

Where conditions favor the use of this modern simplified foundation method, it proves to be not only quicker — and just as safe — but decidedly less expensive than any other method.

WESTERN FOUNDATION COMPANY
WESTERN CONCRETE PILE CORP.

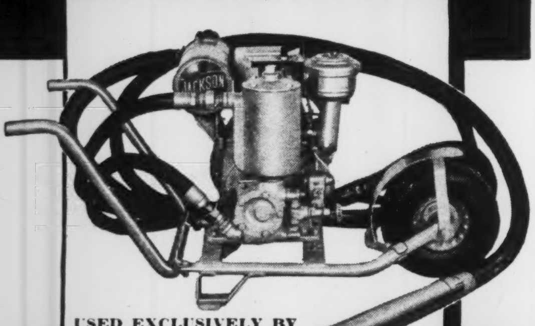
308 W. Washington St., Chicago • 52 Vanderbilt Ave., New York

. . . If you want to make speed profitably . . . GET DEPENDABLE EQUIPMENT . . Buy the Fast . . .

JACKSON Hydraulic Concrete Vibrator

DESIGNED TO "TAKE IT" 3 SHIFTS A DAY—EVERY DAY

- Automatic pressure lubrication—requires no attention.
- 34-ft. hose—2¾" vibrator head.
- Adjustable frequency to 6800 R.P.M.—submerged in concrete.
- Powerful gas engine—4.7 H.P.
- Long-lived, ball-bearing, rotary, hydraulic pump.



USED EXCLUSIVELY BY MANY LARGE DEFENSE CONTRACTORS

ELECTRIC TAMPER & EQUIPMENT CO.
LUDINGTON, MICHIGAN

ENTERPRISE GALVANIZING COMPANY

2500 E. Cumberland St.,
Philadelphia, Pa.

A MODERN GALVANIZING PLANT planned and manned to handle large tonnages!

Galvanized Products Furnished

Prompt shipment via any railroad.
Local delivery by our own trucks.

"SUPPLIERS TO THE U. S. GOVERNMENT FOR OVER 40 YEARS"

KEEP YOUR CONVEYOR BELTS GOING

FLEXCO H D RIP PLATES are used in repairing rips and patching conveyor belts. Their use saves expensive replacements and extended shutdowns.

FLEXCO H D BELT FASTENERS make a strong, tight butt joint with long life. Recessed plates embed in belt, compress belt ends and prevent ply separation. Six sizes in steel and alloys.

● Avoid shutdowns and lengthen the life of your conveyor belts and bucket elevator belts by using Flexco belt fasteners. Thousands of companies have stepped up the performance of conveyor lines and cut costs by using Flexco methods.

Bulletin F-100 shows exactly how to make tight butt joints in conveyor belts with Flexco. Also illustrates step by step the latest practice in repairing rips and putting in patches.

FLEXIBLE STEEL LACING CO.
4656 W. Lexington St., Chicago

Write for your copy.

FLEXCO HD BELT FASTENERS

Sold by supply houses everywhere

insert pivot grinder in the valve opening, then use a hand brace or drill to rotate the grinder. The device has special merits at a time when it is difficult to secure new materials.—*Pivot Tool Co., Homewood Station, Birmingham, Ala.*

Ear Protection

For reducing the detrimental effects of noise upon workers, the M.S.A. Ear Defenders have been put on the market, said to reduce loud noises by 35-45 decibels, or to about one-tenth their former loudness, yet permit warning signals and conversation to be easily heard. The Ear Defender is a tapered tube molded from surgical-type soft rubber, consisting of two barriers, an outer one of metal and an inner one of soft rubber, separated by an air space. The device can be easily cleaned with soap and water, thus insuring a sanitary article at all times. Ask for bulletin No. HA-1.—*Mine Safety Appliances Co., Braddock, Thomas & Meade Sts., Pittsburgh, Pa.*

Defense "V" Light

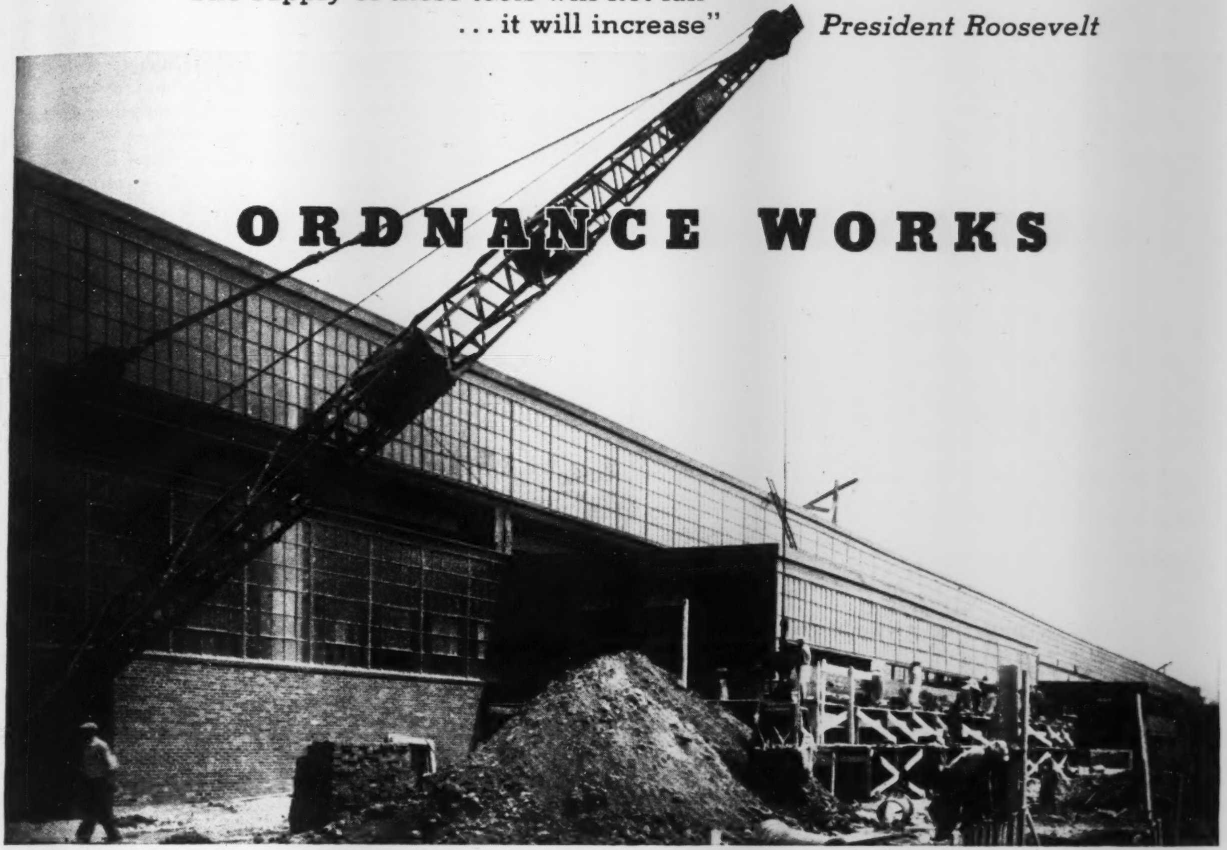
Guarding an increasing number of Uncle Sam's arsenals of democracy at night is this "V" (vertilateral-refractor) luminaire developed by G.E. engineers and found to be particularly effective in protective fence lighting systems. The main features are a deep shading type reflector and a vertilateral refractor designed to control the light both vertically and laterally; thereby doubling the visibility available with the former lights of this general type. It is known technically as Form "79VR."—*General Electric Co., Schenectady, N. Y.*

Welding Electrodes

Two new types of welding electrodes called Harmonang A and B have just been announced by Harnischfeger Corp. as ideally suited for building up and reinforcing 11–14 percent manganese

"The supply of these tools will not fail
. . . it will increase" *President Roosevelt*

ORDNANCE WORKS



Job—buildings for plant to be operated by Westinghouse Electric and Manufacturing Company for producing naval ordnance—at Canton, Ohio.

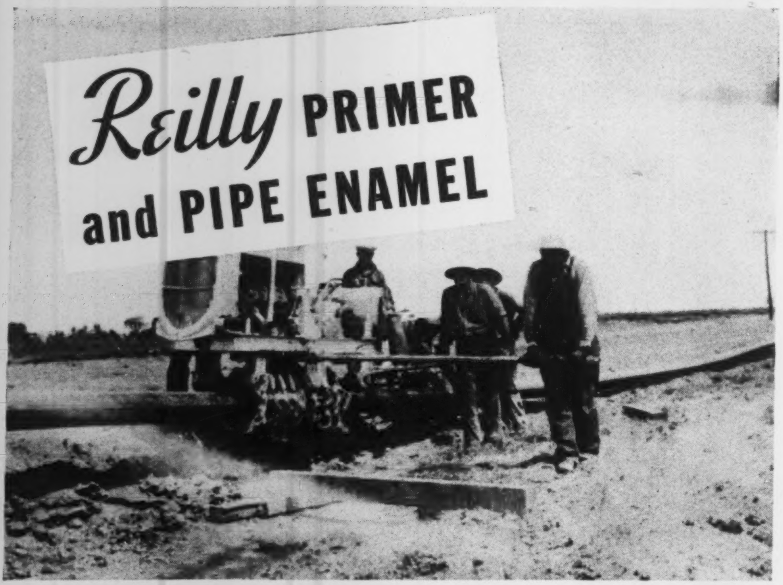
Size—more than 7400 tons of structural steel required. Steel produced, rolled, fabricated and erected by Bethlehem.

Time—first steel delivered at site March 1, 1941. Steel framework erected complete May 9, 1941.

Bethlehem Steel Company is setting new high records for the production of steel and finished steel products for buildings, equipment and other defense matériel.

BETHLEHEM STEEL COMPANY

BETHLEHEM STEEL



POSITIVE PROTECTION
for Oil and Gas Pipe Lines

● Engineers in charge of construction of oil and gas transportation lines, in all sections of the country, have found that coatings of Reilly coal tar enamel offer the best protection against rust and corrosion.

REILLY PRIMER and PIPE ENAMEL, produced from coal tar, bond firmly to the metal, providing a smooth, tough coating that is highly resistant to abrasion and soil stress. This coating will withstand temperatures as low as minus 20°F., without checking or cracking, and temperatures as high as 160° to 170° without flow or sag. Reilly coatings are easily applied by all conventional methods. Write for booklet describing all of these products.

Reilly COAL TAR PRODUCTS

REILLY TAR & CHEMICAL CORPORATION
Executive Offices Merchants Bank Building, Indianapolis, Indiana
2513 S. DAMEN AVENUE, CHICAGO, ILLINOIS 500 FIFTH AVENUE, NEW YORK, N. Y. ST. LOUIS PARK, MINNEAPOLIS, MINN.
FIFTEEN · PLANTS · TO · SERVE · YOU

SIMPLE RUGGED DEPENDABLE CONSTRUCTION EQUIPMENT
STERLING QUALITY

PUMPS — HOISTS
LIGHT PLANTS—SAW RIGS

Sterling Construction Equipment on your job means increased production and larger profits.

Ask for literature and prices

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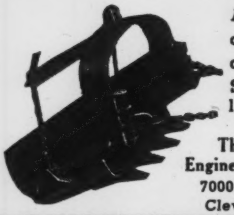
WILLIAMS Buckets
Welded Rolled Steel Construction

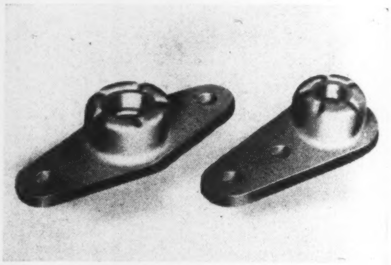


All types and capacities for all conditions. Send for Catalog.

The Wellman Engineering Company
7000 Central Ave.
Cleveland, Ohio

built by WELLMAN

steel or carbon steels where high resistance to impact and abrasion is desired. Type A is a coated manganese-molybdenum electrode on which the thin coating acts as an arc stabilizer and affords protection against loss of manganese and molybdenum. Type B is a bare manganese-molybdenum electrode providing an austinetic deposit. Both electrodes are suggested on such work as building up dipper lips and runners, hammer mill parts, dredge pump shells, rock crusher parts, railway frogs, road grading and mining equipment, etc.—*The Harnischfeger Corp., 4513 W. National Ave., Milwaukee, Wis.*



Anchor Type Stop Nuts

Designed to provide vibration-proof fastenings for removable plates and for other blind mount attachments, anchor nuts are now available which can be permanently riveted to the inside of the structure. The bolts, which are inserted from the outside, pass first through the removable plate, thence through the structure into the stationary nuts. Offered in a wide range of size, material, and thread system, every nut incorporates the basic Elastic Stop self-locking feature, a fibre locking collar which is an integral part of each nut. *Elastic Stop Nut Corp., 2332 Vauxhall Road, Union, N. J.*

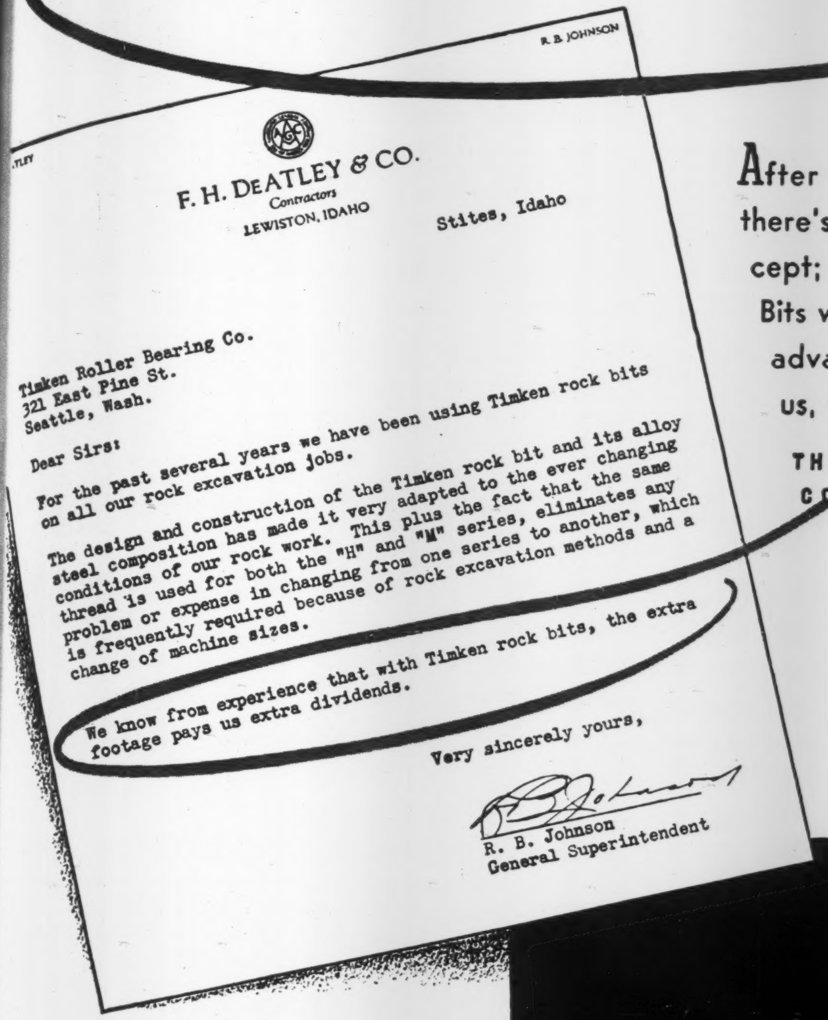
Variable Speed Control

A new V-belt variable speed transmission is especially designed for all "A" section V belt applications and for speed ranges up to 3.3-1. Smooth sided pulleys are used rather than the interlocking type. A positive self-alignment feature makes possible the mounting of this outfit, known as "JFS-CUB," in any and every position without impairing the function or throwing belts out of alignment. — *Standard Transmission Equipment Co., 416 W. 8th St., Los Angeles, Calif.*

Plaster Bases

A chart has been prepared which summarizes basic facts about all types of plaster bases. It is printed on an attractive buff paper and may be mounted

"— —WITH TIMKEN ROCK BITS
The Extra Footage Pays Us Extra Dividends"



R. B. JOHNSON

F. H. DEATLEY & CO.
Contractors
LEWISTON, IDAHO

Stites, Idaho

Timken Roller Bearing Co.
321 East Pine St.
Seattle, Wash.

Dear Sirs:

For the past several years we have been using Timken rock bits on all our rock excavation jobs.

The design and construction of the Timken rock bit and its alloy steel composition has made it very adapted to the ever changing conditions of our rock work. This plus the fact that the same thread is used for both the "H" and "M" series, eliminates any problem or expense in changing from one series to another, which is frequently required because of rock excavation methods and a change of machine sizes.

We know from experience that with Timken rock bits, the extra footage pays us extra dividends.

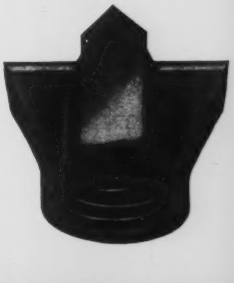
Very sincerely yours,

R. B. Johnson

R. B. Johnson
General Superintendent

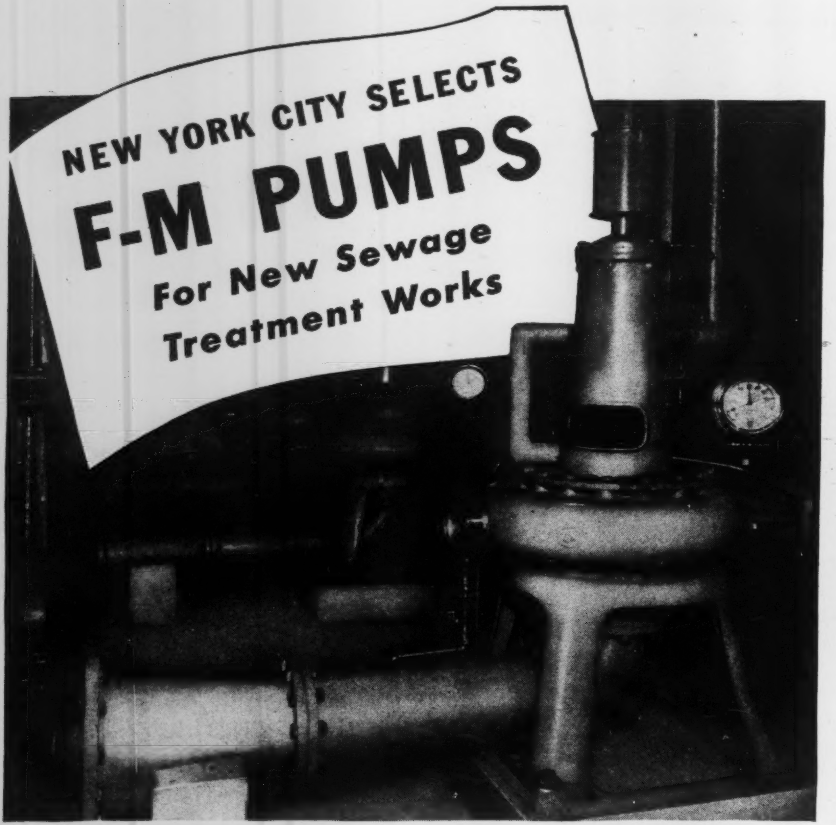
After such a strong testimonial there's nothing left for us to say except; if you are not using TIMKEN Bits why delay investigating their advantages any longer? Write us, we will give you full details.

THE TIMKEN ROLLER BEARING COMPANY, CANTON, OHIO



F. H. DeAtley & Co., drilling with TIMKEN Bits on State Highway Project, Idaho, which will be connected eventually with the Lolo Pass Highway, Missoula and Fort Missoula. Drilling in abrasive Diorite and trap rock, six regrinds are being obtained per bit. This contractor has been using TIMKEN Bits for three years.

TIMKEN
ROCK BITS



AMONG the first of 32 sewage treatment works in New York City's modernization program is the new Tallman's Island plant. Here three Fairbanks-Morse vertical sewage and trash pumps in the low-level station (pictured) provide a total capacity of 12 million gallons per day.

Three F-M typhoon pumps serve the same plant. One, rated at 5000 g.p.h., circulates hot water through the coils of the sludge digestion tank. Two, each of 2500-g.p.h. capacity and fitted with automatic controls and pressure tanks, are in seal water service.

These are but a few of the innumerable ways in which F-M Pumps are serving municipalities everywhere. Whether *your* pumping problem is concerned with sewage or with water supply, and regardless of your capacity requirements, there are pumps in the complete F-M line that will serve you efficiently and economically.

For competent co-operation in determining which pump types and sizes will serve you best, write Fairbanks, Morse & Co., Dept. K29, 600 S. Michigan Ave., Chicago, Ill. Branches and service stations throughout the United States and Canada.

FAIRBANKS-MORSE

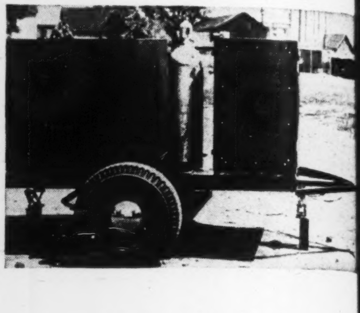
DIESEL ENGINES
PUMPS
ELECTRICAL MACHINERY
FAIRBANKS SCALES
RAILROAD EQUIPMENT

WATER SYSTEMS
WASHERS-IRONERS
FARM EQUIPMENT
STOKERS
AIR CONDITIONERS

F M

Pumps

on the wall, placed under glass top desk, or folded to fit a standard file f ready reference. The wide range plaster bases covered by this chart ca ries through from wood lath to Tru steel, hollow metal lath partitions, an includes various types of resilient sound proof systems. The summary provide data on fire resistance, average soun transmission loss, recommended plaste grounds, normal partition thickness, an quantity of plastering materials r quired.—*United States Gypsum Co Chicago, Ill.*

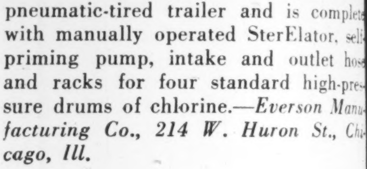


Water Sterilizer

Everson announces a new portable gas SterElator of military type. This portable steel sterilizing plant is mounted on a pneumatic-tired trailer and is complete with manually operated SterElator, self-priming pump, intake and outlet hose and racks for four standard high-pressure drums of chlorine.—*Everson Manufacturing Co., 214 W. Huron St., Chicago, Ill.*

Tank Cart

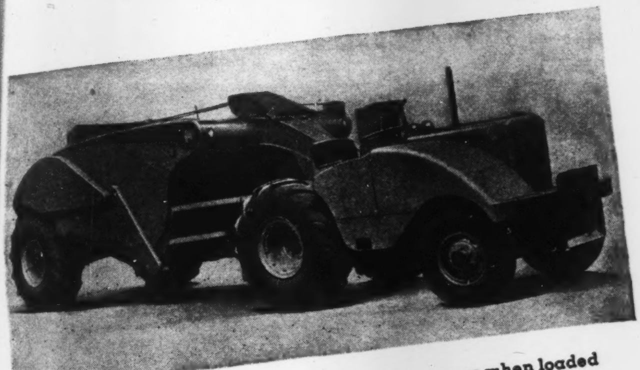
Just perfected is a narrow acetylene tank cart which has a total width of only 24 in., enabling it to pass through any door or passageway. It carries the two tanks one ahead of the other rather than side by side. The outfit is mounted on two large pneumatic tired wheels with 30x3½-in. heavy duty tires so that the carts may be wheeled over rough, uneven ground or littered floors. Either tank may be removed independently of the other. A big steel tool box and two rod holders are conveniently attached to each cart. Ask for GAR-BRO Item No. 730-N.—*Garlinghouse Brothers, 2416 E. 16th St., Los Angeles, Calif.*



Self-Aligning Idler

A swiveling, positive, self-aligning idler for automatically correcting mis-

TRAVEL CLEARANCE FOR DEEP RUTS



High body travel clearance when loaded assures steady hauling over soft and rough haul roads. Reduction of hauling time is increase in loads per hour.

21" Body Travel Clearance Cuts Hauling Time

High loaded body clearance of the Koehring Wheeler permits uninterrupted hauling over deeply rutted haul roads. *Twenty-one* inches clearance, ample flotation and horsepower per gross ton load, are important Wheeler advantages for continuous high speed hauling over rough and soft haul roads. When traveling time is reduced, you get more loads per hour, more yards per shift. Koehring Wheeler Method of Moving Dirt reduces costs per yard and moves more dirt in a shorter time.

KOEHRING HEAVY DUTY

KOEHRING COMPANY • ***Milwaukee, Wisconsin***

HEAVY-DUTY CONSTRUCTION EQUIPMENT

HERE ARE THE
PLAIN FACTS
... About the use of
SOLVAY CALCIUM CHLORIDE
with
PORTLAND CEMENT

Fact No 1 GIVES 9 DIFFERENT ADVANTAGES Reduced Costs, Quicker Set, High Early Strength, Greater Final Strength, Extra Cold Weather Protection, Uniform Curing, Shorter Protection Period, Less Equipment, Increased Density.

Fact No 2 DOES NOT CHANGE THE NORMAL CHEMICAL ACTION OF PORTLAND CEMENT . . . Same action but quicker!

Fact No 3 CAN BE USED WITH ALL TYPES OF PORTLAND CEMENT . . . Standard, high early, white, colored.

Fact No 4 USED AT ALL SEASONS OF THE YEAR Spring or fall—summer or winter.

Fact No 5 FOR ALL TYPES OF CONCRETE . . . Structural, paving, products, mass, ready or transit mix.

Fact No 6 ALL FACTS SUBSTANTIATED . . . By tests conducted by recognized authorities—as well as by 25 years of field testing.

No claims are made for Solvay Calcium Chloride that have not been substantiated both in the field and in the laboratory. The facts listed at the right are backed up by examples of high quality concrete in all parts of the country—some at least 25 years old. They are further substantiated by tests made by high authorities including National Bureau of Standards, Highway Research Board, Portland Cement Association, American Road Builders Association, and Investigating Committee of Architects and Engineers.

SEND FOR BOOKLET CONTAINING COMPLETE INFORMATION

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Gentlemen: Kindly send me a copy of your booklet "Calcium Chloride and Portland Cement."

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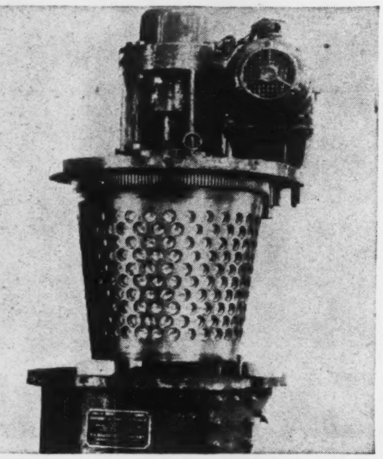
alignment of either carrying or return runs of non-reversing conveyor belts supported on flat-roll idlers, has been announced by Link-Belt. This idler has a centrally pivoted cross member with a vertically-mounted actuating roll at each end for lightly contacting the edge of the belt when its lateral misalignment exceeds a predetermined amount. As a slight pressure of the belt edge against actuating roll serves to swivel the idler unit on its pivot sufficiently to guide the belt automatically and positively back to proper alignment, any possibility of injury to the belt edge is said to be avoided. Folder A-599 gives full information.—*Link-Belt Co., Indianapolis, Ind.*



Strainer

The Brassert automatic self-cleaning strainer, a new addition to the list of water purification equipment, will remove suspended solids from liquids and dispose of them in a continuous, automatic and self-cleaning manner. Used either in conjunction with existing equipment to relieve load on sand filter, etc., or in lieu of settling or baffled tanks, the possibilities of this apparatus should prove of interest to those seeking improvement in water conditioning or other problems involving straining. The strainer consists essentially of a rotating drum, fixed to a vertical shaft, centered within a cast iron housing. The entire vertical surface of this drum is drilled with rows of holes into which is inserted cleaning medium. Solid matter is accumulated on the cleaning disc and carried by the rotation of the drum to the washout slot, where it is flushed out by a reverse flow of cleaning water from inside the drum. The strainers are built in units capable of handling 24,100 gpm. under pressures not to exceed 250 psi., and are rated for head loss of about $1\frac{1}{2}$ lb.—*H. A. Brassert & Co., 60 E. 42nd St., New York, N. Y.*

Compact! Powerful! Safe!

DISTRIBUTABLE CONTROLLED POWER
with Beebe Bros. ALL STEEL HAND HOIST
SEATTLE, U.S.A.
TRADE MARK REGISTERED

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Money Has Been Saved on These Jobs!

1200' assembled pipe (132 Tons) were lowered to bed of Mississippi at St. Paul with 9—5-Ton Beebes, three lines to each hoist through blocks.

Hudson River Bridge sidewalks were laid in sections with 32—5-Ton Beebes.

Longest wooden trusses in world were installed with ONE 5-Ton Beebe after power hoists proved impractical.

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When raising, lowering, or placing costs by power are a serious problem, the answer is the right number of Beebe Bros. All Steel Hand Hoists MANNED IN UNISON. Available in 2, 5 and 15 Ton sizes. Sold through leading dealers in all trade centers. List of dealers sent upon request.

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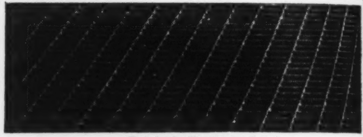
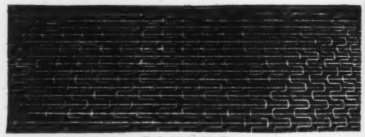
"THE STRONGEST GEARED POWER FOR ITS WEIGHT IN THE WORLD"

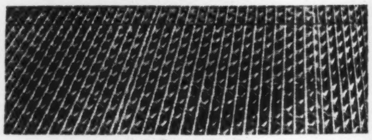
TRI-LOK OPEN FLOORING for all purposes



Tri-Lok Rectangular



Tri-Lok U-Type



Tri-Lok Diagonal

Tri-Lok for strength, rigidity and correct distributing capacity for concentrated loads.

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for catalog giving complete details of various types and adaptability to wide ranges of installation.

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AS NEVER BEFORE

A Heavy Winter's Snow THIS YEAR will need HIGH-CAPACITY SNOW LOADERS — ready and waiting

A LIFTING, DIGGING ACTION FOR EFFICIENCY
Positive Action Self-Feeding Device Handles Any Condition
Pick-Action Paddles to Break up Hard-Frozen Snowpiles

Trucks are likely to be scarce. Men likewise. But fast curb-to-curb snow removal will be more than ever necessary in busy cities. Fore-handed planners will see the necessity for faster loading, to speed up the trips per truck per hour.

The job fits Haiss Snow Loaders like a glove. They've a capacity up to 10 yards a minute. They're rugged, simple and mechanically efficient. They'll start in sub-zero cold, and work 24 hour shifts without a whimper. . . . If you're going to load snow into trucks, this is a machine you've got to know about—early.

NOW ON CREEPER TREADS (Model 75C)

ON PNEUMATIC TIRES (Model 75W)

HAISS

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Please send me your bulletin 1140 on high-speed Snow Loaders.
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When you're in the MIDDLE you have to be

Doubly Sure

No machine builder could afford the exceptional care . . . the precision methods . . . the exhaustive tests used in building Twin Disc Clutches . . . merely to build a clutch for his own machines. His clutch volume would be too small to even justify the cost of setting up for it.

But by specializing exclusively in the manufacture of fine clutches for a variety of industrial uses, the Twin Disc Clutch Company has made it commercially practicable for any builder—no matter how small his volume—to equip his machines with the best friction disc clutches . . . assure his customers better clutch performance . . . longer clutch life . . . at a lower cost per unit.

Because he must satisfy both the machine builder and the machine operator, the clutch specialist "is in the middle" . . . he must be doubly sure that he is right. That's why so many nationally-known manufacturers entrust all their clutch problems to the TWIN DISC CLUTCH COMPANY, 1327 Racine Street, Racine, Wisconsin.

LOWER LEFT: *Twin Disc Power Take-off.*
LOWER RIGHT: *Twin Disc Model E Heavy-duty Clutch.*

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CLUTCHES AND HYDRAULIC DRIVES
REG. U. S. PAT. OFF.

NEW PUBLICATIONS

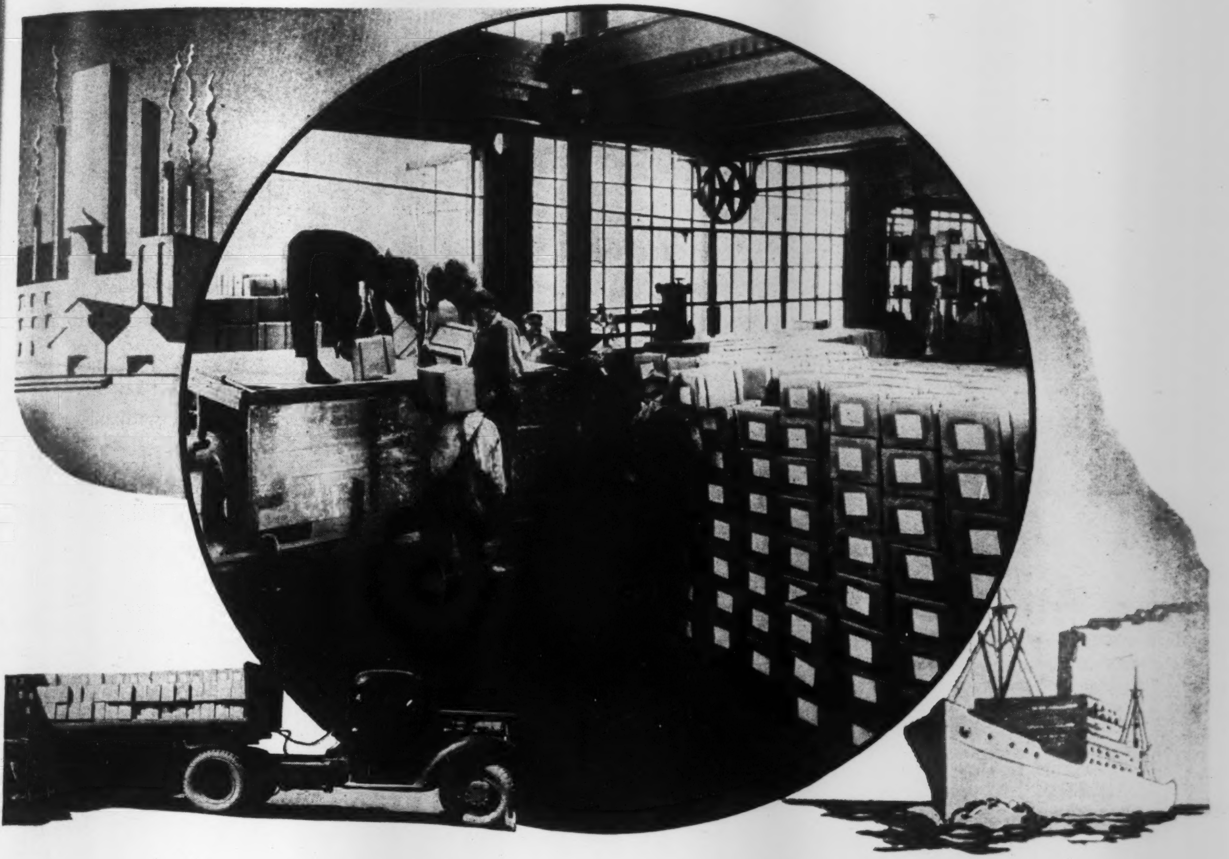
Data for Timber Designers—Three supplements are available for the Douglas Fir Use Book prepared by the West Coast Lumbermen's Association. Flat Top Roof Trusses of Douglas Fir, Blue Ox Series, No. 2, presents a series of design examples of roof trusses for 40-ft., 60-ft., 80-ft. and 100-ft. spans with bills of materials and analysis of joints showing design procedure and governing factors in calculation. Strengths of Lag Screws in Douglas Fir, Supplement No. 3 contains tables of safe loads on lag screws in Douglas fir based on Technical Bulletin No. 597 of the U. S. Department of Agriculture, Forest Products Laboratory. The Scholten Nomograph for solution of the Hankinson Formula, Supplement No. 4, gives two charts for determining the bearing strength of wood on wood, and of bolts, lag screws, pins, etc. on wood at any angle to the grain. All publications are available without charge.—*West Coast Lumbermen's Association, Stuart Building, Seattle, Wash.*

Small Crane—A new 4-page folder, No. 1914 illustrates and describes the one-half yard model LF-50 crawler shovel dragline crane. Particularly described are some of the new design features of this excavator, such as the machine's non-clogging crawler bed; alloy-steel, all welded lower frame and simplified design of upper machinery—*Link-Belt Speeder Corp., 307 W. Pershing Rd., Chicago.*

Compressors—Schramm Catalog 42-P illustrates in complete detail the various types and sizes of portable gasoline engine and diesel engine driven units available. Printed in the two colors in which Schramm's equipment is delivered, the catalog is unusually attractive.—*Schramm, Inc., West Chester, Pa.*

Prefabricated Construction — An 8-page bulletin entitled "How to Assemble Lindsay Structure" has just been released to give information on the new light weight steel, prefabricated construction which can be used for many purposes including machine housings, truck bodies, industrial buildings, etc.—*Dry-Zero Corp., 222 N. Bank Drive, Chicago.*

Cement—The making of concrete that will resist the corrosive action of many industrial solutions and wastes is described in a recently published booklet. "Lumnite for Corrosion-Resistant Concrete." The booklet gives a summary of experience with corrosion-resistant con-



From overseas defense bases, comes the call . . . for asphalt flooring blocks

Wherever Hastings Asphalt Blocks are shipped, to cold climates or to the tropics, they are produced to suit prevailing conditions, to stand up under the heaviest loads, the busiest traffic.

Tough, shock absorbing, they will endure under expansion and contraction, impact, wear and tear.

Specify Hastings and be assured that your floor, like your other important tools of production, will be built to *Exact Specifications.*

THE HASTINGS PAVEMENT CO.
25 Broad Street, New York City

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again serving
AMERICAN
DEFENSE
INDUSTRY

Hastings

ASPHALT BLOCK
FLOORS AND PAVEMENTS
Since 1885

IN WAR...AS IN PEACE
Arkwright stands for quality!

Whether American industry is producing the weapons of war or the tools of peace, Arkwright stands ever ready to meet industry's needs with the same high quality tracing cloth!

Years of testing in Arkwright laboratories . . . years of insistence on highest quality materials and highest standards of manufacturing have prepared Arkwright for the present emergency. Today, you can order Arkwright tracing cloths with the same confidence in quality . . . the same assurance of rapid delivery that has given Arkwright its recognized position as the leading American producer of tracing cloth for over twenty years! Arkwright Finishing Co., Providence, R. I.

Arkwright TRACING CLOTHS

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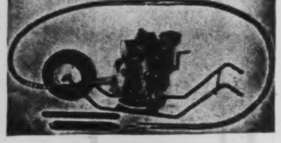
TRACING CLOTH
PENCIL TRACING CLOTH

LOW COST
RELIABLE



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15 to 50 TONS CAPACITY
DIESEL • ELECTRIC • GASOLINE • STEAM
The OHIO LOCOMOTIVE CRANE CO.
BUCYRUS . . . OHIO

crete and mortar in a variety of industries and presents records of service of structures under severe conditions.—*The Atlas Lumnite Cement Co., Chrysler Bldg., New York City.*

Tanks and Pipe—Alco Products Bulletin 1030 illustrates the type of material available for the oil and chemical industry, power plants, municipalities and general use.—*American Locomotive Co., Alco Products Division, 30 Church St., New York, N. Y.*

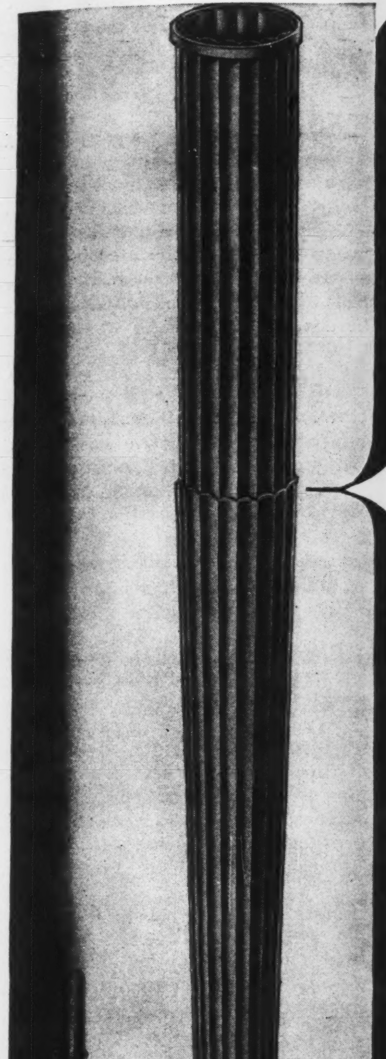
Steel—A 12-page rotogravure folder provides a picture trip to the Ceco Steel plant in Chicago featuring the manufacture of industrial steel windows and doors, metal lath and accessories, weather strips, roof decks and steel joists.—*Ceco Steel Products Corp., 5701 W. 26th St., Chicago, Ill.*

Wire Screen Cloth — Woven Wire Screen Cloth is the subject of Bulletin No. 113 which describes Robins screen cloth wire. The 8-page booklet gives full information on metallurgy and specifications for screen cloth wire for vibrating screens, for material sizing and other uses.—*Robins Conveying Belt Co., Passaic, N. J.*

Air Conditioning—"How Air Conditioning Builds Business Profits" is a report of a round table clinic on air conditioning sponsored by Chrysler Airtemp at Dayton, Ohio last summer. This book, of more than 50 pages contains many ideas regarding air conditioning as well as a number of statistics.—*Chrysler Airtemp Div. of Chrysler Corp., Dayton, Ohio.*

Sewage—"Municipal Sand Filter for Sewage" and "Multi-Zone Multiple Hearth Furnace for Sewage Sludge and Screening" are the titles of new publications. These booklets describe units in various locations and describe their operations in sewage treatment.—*Underpinning and Foundation Co., Inc., 155 E. 44 St., New York, N. Y., Allied Engineering Equipment Corp., Cunard Bldg., Philadelphia, Pa., sales representatives.*

Air Reduction—A detailed description of the activities of the five companies which comprise Air Reduction Co., Inc., is contained in a 54-page book illustrated with pictures and diagrams completely describing the methods, the markets and the nature of the company's business. Compiled primarily for distribution to stockholders and employees it is available to anyone interested in the progress of the following organizations: Air Reduction Sales Co., National Carbide



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OFFER YOU IMPORTANT ECONOMIES

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ELIMINATE WASTE

The Monotube Method provides cast-in-place concrete piles of the exact length to meet each job requirement. After driving the main lower tapered section, constant taper extensions are added to obtain the necessary total length. Installation is simple and speedy. Any number of extensions, which are available in 12″, 14″, 16″ and 18″ diameters, can be added in this manner. Extendable Monotubes up to 125 ft. in length have been installed successfully.

PERMIT DRIVING IN LOW HEADROOM

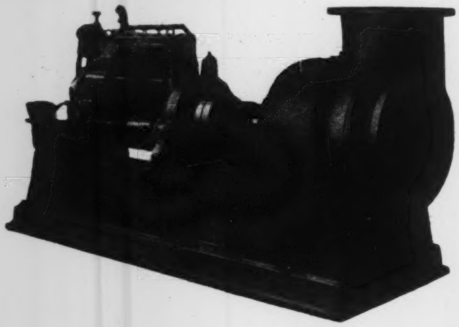
Low headroom presents no problem with Extendable Monotubes. Installation in two or more sections, as described above, permits fast, efficient driving in restricted areas.

PROVEN MONOTUBE FEATURES

Extendable Monotubes are light weight for easy handling, require no core or mandrel, can be driven with standard crane, leads and hammer, and lend themselves to thorough inspection after driving. Write today for complete information.

THE UNION METAL MANUFACTURING CO.
CANTON, OHIO

MORRIS CENTRIFUGAL PUMPS



for Sewage and Drainage

Morris Centrifugal Sewage and Drainage Pumps, like the Morris designs for water supply, are notable for their high efficiency; and in addition, have special features which assure non-clogging and trouble-free service. These designs are built both vertical and horizontal, and for standard or low-speed motors and other methods of drive. Full information on request.

MORRIS MACHINE WORKS . . . . BALDWINSVILLE, N. Y.

IRRIGATION DITCH IN TEXAS

Above is shown a section of a finished "GUNITE"-lined irrigation ditch in the Rio Grande delta, Texas, part of many miles built by this method. Ditches of this design, being free from joints, exclude vegetation and are leak-proof.

Canals, flumes and conduits lined with reinforced "GUNITE", as well as a large variety of other work, are illustrated in our Bulletin 1200. Send for a copy.

The "CEMENT GUN" can be bought by anyone, and used without restrictions.

CEMENT GUN COMPANY
Manufacturers of the "CEMENT GUN"
ALLENTOWN, PENNSYLVANIA

WE ARE ALSO "GUNITE" CONTRACTORS
LET US BID ON YOUR WORK

Handle materials at long ranges profitably!

for . . .
SAND
GRAVEL
STONE
COAL
ORE

Combine three jobs (digging, hauling and placing) into one economical operation.

A SAUERMAN Scraper penetrates hard materials with the ease of a plow-share, and both in digging and conveying it requires much less line-pull than any other scraper of equal rated capacity. It digs a heaping load in a few seconds, moves this load rapidly over the ground, dumps cleanly when it reaches the dumping point and then returns at high speed for another load.

For full details of SAUERMAN Scrapers, handling capacities, methods of operation, etc., etc., write for Bulletin 147.

SAUERMAN BROS. INC.
432 S. Clinton St., Chicago

Small Sauerman Scraper strips overburden from ore deposit at rate of 60 cu. yd. per hour, placing the spoil in a high pile.

Corp., Wilson Welder & Metal Co., Inc., Pure Carbonic, Inc. and the Ohio Chemical & Mfg. Co.—*Air Reduction Sales Co., New York City.*

Steam Cleaner—An 8-page folder describes the Hypressure Jenny steam cleaner for automotive, construction and industrial machinery and many other uses. The several models of units available and material which can be used in them are described.—*Hypressure Jenny Division, Homestead Valve Manufacturing Co., Coraopolis, Pa.*

Safety—"Safety Requirements in Excavation-Building-Construction" is the title of a comprehensive booklet issued for War Department guidance. It describes in detail minimum requirements for safety on construction work.—*War Department, Office of the Quartermaster General, Construction Division, Washington, D. C.*

Blowers—A 64-page combined catalog and engineering data book on Universal blowers has just been announced. Colorfully printed and profusely illustrated, the book features Ilg's four lines of direct-connected and belted blowers, plus two lines of volume blowers and outlines their advantages.—*Ilg Electric Ventilating Co., Chicago, Ill.*

Wire Rope—A folder titled "Select the Correct Wire Rope" describes wire rope construction and outlines the proper rope for different uses.—*MacWhyte Co., Kenosha, Wis.*

Hard Rubber—A 32-page booklet entitled "A Hard Rubber Manual" is said to be the first publication of its kind which concisely outlines the characteristics and manufacturing procedure for hard rubber. It tells what hard rubber is, how it is compounded and molded and is generously illustrated and compared with other modern thermo-setting plastics.—*Advertising Dept., Jos. Stokes Rubber Co., Trenton, N. J.*

Crushers—Three new pamphlets are available on aggregate and material crushers: An 8-page export bulletin, No. ES-1 illustrates and describes all Cedarapids crushing equipment in Spanish; Bulletin No. A-4 illustrates the Cedarapids roller bearing and plain bearing jaw crushers in the complete range of sizes from 9x12 in. to 25x40 in.; and Bulletin K-2 covers the Cedarapids "Kubit" impact breaker pointing out construction features and picturing difficult installations.—*Iowa Manufacturing Co., Cedar Rapids, Iowa.*

Manufacturers' Activities

Herbert E. Smith, vice president of Vulcan Rivet & Bolt Corp., Birmingham, Ala., has been elected president. Mr. Smith was made vice president and placed in actual charge of the company in July, 1940, following the death of President W. C. Martin.

The corporate name of Hydrocarbon Chemical & Rubber Co., Akron, Ohio, jointly-owned enterprise of The B. F. Goodrich Co. and the Phillips Petroleum Co., now manufacturing synthetic rubbers, has been changed to Hycar Chemical Co. it is announced by R. W. Thomas, president. The firm has recently been designated by the Defense Plant Corp. to build and operate another synthetic rubber plant at Louisville, Ky.

Wallace W. Lockwood has been appointed advertising manager of the Taylor Instrument Companies, Rochester, N. Y., to replace Elmer E. Way, who has resigned.

The LeRoi Co., Milwaukee, has announced the following new distributors of the complete line of LeRoi portable air compressors: Wylie-Stewart Co., 1400-1426 Exchange Ave., Oklahoma City, Okla.; H. W. Findley Co., 2 Glass Ave., Carnegie, Pa.; Grafflin S. Prather, 7 Canal St., Red Bank, N. J., and W. T. Walsh Equipment Co., 3088 W. 106th St., Cleveland, Ohio.

Lone Star Cement Corp. of New York has announced the election of R. A. Hummel as president and general manager to succeed the late Charles L. Hogan.

Robert H. Bahney, of Massillon, Ohio, has been promoted to the position of assistant chief engineer of the Republic Steel Corp., with offices at Cleveland. Mr. Bahney went into the engineering department of Republic in 1936. Eugene W. Phillips, his former assistant, will succeed Mr. Bahney as chief engineer of the corporation's central alloy division at Massillon.

Frank Seamans has been elected president and a director of the Barber Asphalt Corp. of Philadelphia. Mr. Seamans has been a vice president of the company since 1920. The board also elected T. Rieber, formerly chairman of the Texas Corp. as a director of the company and at the same time named E. R. Riter as vice president in addition to his duties as secretary of the company.

William A. Thompson, vice president

Keeping open the highways of NATIONAL DEFENSE

● To provide for the army that "travels on its stomach," food and material must use the highways, railways and airways. Keeping open these lines of communication is vital to national preparedness, and in all three, GOHI Corrugated Pipe contributes its share, by providing drainage structures to safeguard highways, railway road beds and airports. Buried in the ground, withstanding wear, weather, corrosion, abrasion, the impact of heavy travel, settling and shifting earth, sudden changes in temperature, alternate thawing and freezing, and a score of other destructive conditions, GOHI Corrugated Pipe earns its service stripes for duty ably performed.

A copy of the 72-page GOHI Book on drainage practice is yours for the asking. Well worth writing for. Address the fabricator nearest you.

GOHI PIPE CORRUGATED

NEW ENGLAND BOLT CO.	Everett, Mass.
CENTRAL CULVERT CO.	Ottumwa, Iowa
CAPITAL CITY CULVERT CO.	Madison, Wis.
BANCROFT & MARTIN ROLLING MILLS CO.	S. Portland, Me.
DENVER STEEL & IRON WORKS CO.	Denver, Colo.
THE LANE PIPE CORPORATION	Bath, N. Y.
DIXIE CULVERT MFG. CO.	Little Rock, Ark.
ST. PAUL CORRUGATING CO.	St. Paul, Minn.
THE NEWPORT CULVERT CO.	Newport, Ky.

GOHI CULVERT MANUFACTURERS, INC., NEWPORT, KY.

Throughout the Nation • **OWEN BUCKETS** *are*

DIGGING

Caissons • *Trenches* • *Foundations*

MOVING

Various Materials • • •

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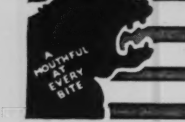
Coal • *Coke* • *Sugar Beets* • *Etc* • •


A MOUTHFUL AT EVERY BITE

THE OWEN BUCKET CO. 6010 BREAKWATER AVE. CLEVELAND, O.

BRANCHES: NEW YORK PHILADELPHIA CHICAGO BERKELEY, CAL.

OWEN CLAMSHELL BUCKETS INSURE A BIGGER DAYS WORK

MITCO

OPEN STEEL FLOORING

Pressure Formed—90% Open Area

Easy to Install

Hendrick Manufacturing Company

45 Dundaff Street, Carbondale, Pa.

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THE WORLD'S LARGEST MAKERS OF LIQUID METERS

1892 . . . 1941

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Branches in Principal American Cities and in Canada

Trident Meters

★ *Illuminate Danger Points when you need it!*

USE CATAPHOTE REFLECTOR BUTTONS

Ideal for better traffic control in all types of construction jobs . . . including roads, streets, bridges and industrial plants. Write for more facts.

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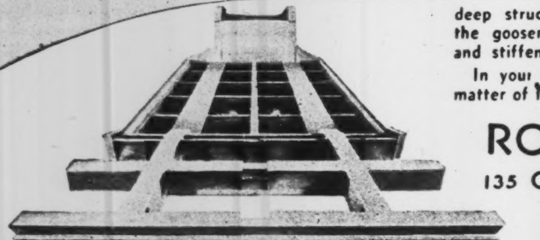

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and secretary of the Allis-Chalmers Mfg. Co., Milwaukee, has resigned because he has reached the retirement age of 65 years. No successor will be appointed, Mr. Thompson's work being distributed among other officials.

Induction Heating Corp. has moved to new quarters at 389 Lafayette St., New York—a move which enlarges their previous space tenfold. A large part of the floorspace will be devoted to research laboratories where induction engineers will handle individual problems requiring practical tests and studies.

Wallace F. Ardussi, formerly with the Chrysler Corp. and Airtemp, has been placed in charge of research and product development for Foote Bros. Gear & Machine Corp. of Chicago. W. A. Barr is president and general manager of the company.

Robert B. Boand has been appointed branch manager of Union Wire Rope Corp. of Houston, Tex., with headquarters at the warehouse at 329-33 North Front St., New Orleans. Mr. Boand has been representing Union in Texas with headquarters at Houston for the past two years, and prior to that time was in main office sales at Kansas City, Mo.

Three executives of the Pittsburgh Equitable Meter Co. have recently been called for active military duty in different branches of the service: Col. W. F. Rockwell, president of the company, was called for extended active service early in October, reporting to Washington, D. C., where he has been serving as assistant to the chief of the Motor Transport Division. Capt. A. E. Higgins, vice president of the company, originally called in midsummer for active duty in the Air Corps, has been temporarily deferred due to certain national defense activities in which the Pittsburgh firm is engaged. For the past eight months Capt. J. R. Sproat of the sales staff has been serving with the 176th Field Artillery at Fort Meade.

Walter B. Harris, vice president, treasurer and director of the Ruberoid Co., of New York, died Nov. 1 in New York, following an illness of several months.

An asbestos mill capable of processing large quantities of asbestos-bearing rock is now under construction on the Johns-Manville properties in Chrysotile, Ariz. According to C. H. Shoemaker, vice president of Johns-Manville Products Corp., the new mill will be in operation early in 1942, and will add substantially to the supply of asbestos fiber available in this country to meet defense manufacturing needs.

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CONSTRUCTION REPORTS

Compiled by Business News Department—Engineering News-Record, 330 W. 42nd St., New York

ELSIE EAVES, Manager *SCOTT McLEOD, Statistician*

(Daily service also available—Write for details)

Location of ENR Correspondents

Symbols and Abbreviations Include:

†	Federal Government
★	Project of $500,000 or over
ENR	Engineering News-Record
CD	Engineering News-Record Construction Daily

Projects—By Size

Construction projects here reported cover the United States and Canada, are of these minimum sizes or larger: water supply, earthwork, waterworks, $15,000; other public works, $25,000; industrial buildings, $40,000; other buildings, $150,000.

Classes of Construction

(Named in order of Listing)

Water Supply
Sewers, Waste Disposal
Bridges, Grade Cross'gs
Streets & Roads
Earthwork, Waterways
Unclassified
Latin America
Public Buildings
Commercial Buildings
Industrial Buildings

Stages Reported

PROPOSED: (except Streets & Roads):

BIDS ASKED (new announcements only. For full calendar, see also preceding issues of ENR);

LOW BIDDERS: All low bidder news will be the final reports published on the projects involved except where award is not made to the low bidder. In this case, a supplementary contract award report will be published.

CONTRACTS AWARDED: Except awards to low bidders previously reported in low bidder stage.

Dates shown are of issue in which last previous report was published.

WATER SUPPLY

PROPOSED WORK

Ala., Dothan—2 water wells, 2 watermains. $38,844. Applied for DPW funds.

Calif., Martinez—Contra Costa Water Dist., Martinez, plans bond election in Mt. View area of dist. for pipeline connection with Contra Costa Canal Project. Over $25,000.

Idaho, Nampa—Watermain imprvs., extens. $66,000.

Idaho, Orofino—500,000 gal. water reservoir. R. F. Edwards, City Hall, engr.

†Md., Rockville — Washington Suburban Sanitary Dist., water distr. sys., extens., addn., Docket Md. 18-149. $20,900. **DPW.**

†Mass., Chicopee—City, watermains, Docket Mass. 19-104. $320,531. Hayden, Harding & Buchanan, 622 Park Sq. Bldg., Boston, archts. CD 11/3—ENR 11/6.

†Mich., Center Line—City, water distr. sys. addn., Docket Mich. 20-159. $31,400. **DPW.**

Mich., Fair Haven—Ira Twp., Township Clerk, waterworks filtration plant, equipt., one 150,000 gal. rein.-con. reservoir. $60,000. Ayers, Lewis, Norris & May, Ann Arbor, engrs.

N. J., Livingston—Water supply area imprvs., 100 ft. concrete dam, etc. $38,500. WPA. W. Willegarod, Town Hall, East Orange, owner's engr.

N. Y., Watervliet—Dpt. P. Wks., water supply. $150,000. Solomon & Keis, 257 Bway., Troy, engrs.

†Okla., Dawson—Town, water distr. sys. addns., extens., Docket Okla. 34-137. $33,000. **DPW.** Wood & Craig, Philcade Bldg., Tulsa, engrs.

★**†Okla., Tulsa**—Bond election Dec. 2, 1,800 ft. 36 in. force feeder main, enlarging filter plant, Docket Okla. 34-105. $558,895. **DPW.** W. F. McMurry, City Hall, engr. CD 10/28—ENR 10/30.

Ore., Pendleton—Imprv. distr. sys., constructing 5,500 ft. 24 in. pipeline, North Wenix intake area. Over $100,000. WPA funds sought.

†S. C., North Charleston—St. Phillips and St. Michaels Pub. Serv. Dist., 2 mi. watermains, etc., Docket S. C. 38-151. $15,836. **DPW.** The John McCrady Co., 9 State St., Charleston, engrs.

Tenn., Decatur—W. J. Abel, mayor, water sys. $41,680.

Tenn., Kingsport—F. L. Cloud, city mgr., filter plant, imprv. water sys. $113,000. Wiederman & Singleton, Candler Bldg., Atlanta, Ga., engr.

Tex., Baytown—Baytown Utilities Corp., c/o R. M. Read, Baytown, WW., 2 wells, 200,000 gal. concrete storage tank, mains, etc. $80,000. Applied for DPW funds. J. B. Dannenbaum, 2136 Albans Rd., Houston, engr.

★**Wash., Tacoma**—Replacement trunk watermains, $800,000; 3 mi. Green River gravity water supply line, $450,000. CD 2/14—ENR 3/20. DPW funds sought. W. A. Kunigk, water supt.

†Wash., Tacoma—Pierce Co. Fire Dist. 2, c/o Regional DPW Office, Alaska Bldg., Seattle, bids soon, furnishing 198,000 ft. 2- to 12-in. pipe, gates, valves, valve boxes for $400,000 water distr. sys., south of here. Parker & Hill, engrs, Smith Tower, Seattle. CD 7/16—ENR 7/24.

Ont., Kingston—Gore & Storrie, engrs., 1130 Bay St., Toronto, WW imprvs., 1,200 ft. intake, and inlet under lake surface, distr. mains, Beverly and Union Sts., temporary pump sta., King St. W. $300,000. CD 5/8—ENR 5/15.

Ont., London—Utilities Comn., E. V. Buchanan, genl. mgr., main, Ridout St. S. $25,000.

Que., Quebec City—Dominion Govt., Ottawa, Ont., reservoir. $30,000. Dpt. Munitions & Supply, Ottawa, Ont., engrs.

Que., Ste. Agathe—B'Nai Brith Assn., Lac Long, water and sewerage sys., etc. $35,000. Myerovitch & Bernstein, 1178 Philip Pl., Montreal, archts.

BIDS ASKED

Bids Asked November 25

O., Racine—Village, WW imprvs. P. W. Elwell, 5005 Euclid Ave., Cleveland, engr. CD 8/28—ENR 9/4.

Bids Asked December 16

†Okla., Tulsa—Exten. filtration plant to increase capacity by 16 mgd, mixing basin, 24 mgd pump and accessories, Docket Okla. 34-101. $340,499. **DPW.** W. F. McMurry, City Hall, engr. CD 10/28—ENR 10/30.

LOW BIDDERS

†Ala., Childersburg—City, Nov. 7, WW and sanitary sewer imprvs., Docket Ala. 1-102, from Sullivan, Long & Hagerty, Ltd., Bessemer, **$236,159.** Est. $231,159. **DPW.** CD 10/27—ENR 10/30.

†Calif., Victorville—U. S. Eng., 751 S. Figueroa St., Los Angeles, Nov. 12, water supply sys., Victorville Military Airport, from Ford J. Twaits Co., 816 W. 5 St., Los Angeles. **$46,540.** CD 11/5.

CONTRACTS AWARDED

†Ala., Mobile—U. S. Eng., Federal Bldg., Mobile, water tank, Gunter Field, to Chicago Bridge & Iron Co., 1500 N. 50 St,. Birmingham. **$42,985.** Bids 10/29, awarded 10/30. CD 10/21—ENR 10/23.

†Calif., Watsonville—Con. Q.M., Fort Ord, wells, pump. facilities, Camp McQuaide, Inv. Q.M., 6941-42-2, to E. S. Friend, 309 Stanford St. **$16,985.** Bids 11/10. CD 11/3.

†Mo., Waynesville—Defense Pub. Wks. Div., FWA, 302 Porter Bldg., Kansas City, Mo., concrete reservoir, pump house, water distr. sys., mains, etc., Docket Mo. 23-109, to E. J. Fischer, 413 Westminster Pl., St. Louis. **$81,083.** Est. $110,000. Bids 11/5, awarded 11/7. CD 11/7.

Neb., Bellevue—H. Freeman, mayor, WW imprvs., **WPA. $140,000.** Henningson Eng. Co., Standard Oil Bldg., Omaha, engrs. CD 7/21—ENR 7/24.

N. C., Cleveland—P. Wilson, mayor, WW and sewerage sys., **WPA. $48,615.**

N. C., Grifton—W. J. Bissett, mayor, water and sewer imprvs., **WPA. $63,584.**

Wash., Cathlamet—Public Utility Dist. 1, water supply sys. for Puget Island to O. L. Soule, Elma. **$65,534.** Bids 11/10. CD 10/17—ENR 10/23.

Alta., Shepard—Dpt. National Defense for Air, Ottawa, Ont., water and sewerage sys., Relief Intermediate Aerodrome, to Bennett & White Constr. Co. Ltd., 302 Examiner Bldg., Calgary, **$18,000.**

Ont., London—Utilities Comn., E. V. Buchanan, genl. mgr., WW. own forces. $25,000.

Que., Mont Joli—Dpt. National Defense for Air, Ottawa, Ont., pump. house and equip., No. 9 Bombing and Gunnery School, to Collet Freres, Ltd., 1978 Parthenais St., Montreal. **$20,000.**

Que., Ville La Salle—Watermain, Lafleur Ave., day labor. **$55,000.** W. E. Lauriault, 861 Convent St., Montreal, engr. CD 10/31—ENR 11/13.

Sask., Estevan—Dpt. National Defense for Air, Ottawa, Ont., water and sewer services, S.F.T. School, to Henry Borger & Sons, Ltd., 194 Osborne St., Winnipeg, Man., **$70,000.**

Sask., North Battleford—Dominion Govt., Ottawa, Ont., WW sys., to W. C. Wells., Wilkie, **$31,000.** Dpt. Munitions & Supply, Ottawa, Ont., engrs.

Sask., St. Aldwyn—Dpt. National Defense for Air, Ottawa, Ont., water and sewerage sys., to Saskatoon Contg. Co. Ltd., 817 2 Ave., Saskatoon. **$19,000.**

SEWERS WASTE DISPOSAL

PROPOSED WORK

†Ark., Hope—City, relief sewers, Docket Ark. 3-120. $18,000. **DPW.** CD 9/17—ENR 9/25.

†Calif., Salinas—City plans $195,000 bond election imprv. sewage treatment plant and collection sys. Docket Calif. 4-142. **DPW** approved $195,000 gr. H. N. Jenks, 345 Madrone Ave., Palo Alto, engr. CD 11/7—ENR 11/13.

Calif., Santa Cruz—Surveys sewage disposal imprvs. Over $25,000. H. N. Jenks, 345 Madrone Ave., Palo Alto, engr.

Ill., Decatur—Decatur Sanitary Dist., Dr. W. D. Hatfield, supt., sewerage sys. area at junction Routes 48 and 51. $40,000.

Ill., Franklin Park—Cook Co., County Bldg., Chicago, 6,247 ft. storm sewer, 25 Ave. $40,000. G. H. Baker, Centennial Bldg., Springfield, state engr. co. roads and city streets.

Ia., Mason City—Preliminary plans sewage disposal plant. $190,000. Howard Green & Co., Cedar Rapids, engr.

Ia., Middletown — Sewage disposal plant. $47,500. Application filed with DPW.

†Nev., Hawthorne—Town, sewage treatment plant, sanitary sewer lines, Docket Nev. 26-101. $45,577. **DPW.**

N. Y., Brooklyn—President Brooklyn Boro, Boro Hall, sewers, Flatbush Ave. $32,000. Fairfield Ave. $150,000.

N. Y., Massena—Sewage disposal plant, incinerator. Over $25,000. Wm. S. Lozier, Inc., 10 Gibbs St., Rochester, engrs. CD 10/6—ENR 10/9.

★**O., Akron**—Defeated $800,000 bonds, miscellaneous sewage imprvs., extens. J. E. Soderberg, city engr. CD 9/23—ENR 9/25.

O., Cleveland—Workmans Housing Corp., A. W. Jennings, secy., 2341 Carnegie Ave., sewer, water lines, roadways, utilities for housing project site. W. F. Bennett, Jr., 2341 Carnegie Ave., engr.

O., Kent—Approved $150,000 bonds, sewer extens. $475,000. J. G. Osborne, city engr. CD 8/28—ENR 9/4.

O., Medina—Approved $65,000 bonds, sanitary sewerage exten. E. D. Barstow, 31 N. Summit St., Akron, engr. CD 9/11—9/18.

★**Okla., Tulsa**—Bond election Dec. 2, sewage disposal plant, 15,500,000 gpdc, vicinity 5 St. and Arkansas River, incl. 7½ mi. 8- to 54-in. interceptor, 3 river crossings, 5 uplift stations, one 24 in. collector main, 8,300 lin. ft. c.i. pipe 2,000 ft. tile sewer, $1,037,000; storm sewers, drainage structures, 26 projects involving 36 to 84 in. sewers, $709,000; 7 sanitary sewer projects, involving 8- to 24-in. pipe, $264,000. W. R. Wooten, city engr. CD 9/9—ENR 9/11.

SEWERS, etc. (Proposed Work, Cont'd.)

Ore., Springfield—Voted $165,000 bonds, sewage disposal plant. CD 8/6—ENR 8/14.

Tex., Baytown—Baytown Utilities Corp., Baytown, sanitary sewerage sys., treatment plant, sewage lift pump, manholes, pipe, etc. $124,150. Applied for DPW funds. J. B. Dannenbaum, 2136 Albans Rd., Houston, engr.

★**†Tex., Corpus Christi**—City, A. C. McCaughan, mayor, installing sanitary sewer collecting mains, Tex. 41-174, $350,000, **DPW**, F. T. Stafford, 1921 Post Office, Galveston, engr.; precast 12- to 138-in. storm sewer lines, etc., $750,000, **DPW.** CD 11/7—ENR 11/13. G. Blackburn, city engr. and Myers & Noyes, Tower Petroleum Bldg., Dallas, engrs. for both projects.

Tex., Dallas—V. R. Smitham, city mgr., storm sewers. $300,000.

Tex., McKinney—F. D. Perkins, mayor, rejected bids Nov. 3, East Side sewerage treatment plant addn., imprvs. Koch & Fowler, Great Natl. Life Bldg., Dallas, engrs. CD 10/22—ENR 7/10.

Tex., Moulton—Voted bonds sanitary sewerage sys. $28,000.

†Tex., Texarkana—City, sanitary sewerage sys. imprvs., $315,000, and 1 story, 27x41 ft. brick, concrete incinerator, $79,000, Tex. 41-165. **DPW.** J. J. Rady, Majestic Bldg., Fort Worth, and J. Montgomery c/o Littlefield Bldg., Austin, engrs. CD 9/26—ENR 10/2.

BIDS ASKED

Bids Asked November 26

†N. Y., Sidney—Public Bldgs. Admin., 7 and D Sts. S.W., Wash., D. C., sewage treatment plant for housing.

LOW BIDDERS

†Ala., Sylacauga—City, Nov. 7, sewage treatment plant, outfall line, Docket Ala.-1-101, from Bush Building Co., 805 8 Ave. N., Nashville, Tenn., **$206,802.** Est. $206,800. **DPW.** 10/27—ENR 10/30.

†Tex., Orange—City, c/o H. Sokolski, mayor, about Nov. 9, sanitary sewer imprvs., sewage lift station, from P. O. Sorenson, Inc., 1706 Cockrell St., Dallas, **$64,784;** disposal plant enlargement, from Theo. Jensen, Pasedena, **$79,323,** Tex. 41-196. **DPW.** CD 11/6—ENR 10/30.

CONTRACTS AWARDED

†La., Leesville—Town, sewers, sewage treatment plant, Docket La. 16-101, to Glassell-Taylor Co., 318 Carondelet St., New Orleans, **$150,740. DPW.** Bids 10/17, awarded 11/11. CD 10/8.

N. J., Millville — 8 and 10 in. sanitary sewer extens., laterals, etc., **WPA. $50,808.** G. R. Swinton, 930 Atlantic Ave., Atlantic City, WPA engr. CD 10/23—ENR 10/30.

N. J., Perth Amboy—8 in. vitr. tile lateral sewers, 6 in. house connections, etc. **WPA. $78,069.** CD 10/27—ENR 10/30.

N. J., Vineland—Landis Twp., Twp. Hall, storm sewers, catch basins, manholes, etc., **WPA. $55,543.** G. R. Swinton, 930 Atlantic Ave., Atlantic City, WPA engr. CD 10/27—ENR 10/30.

N. Y., Ballston Spa—Bd. Village Trustees sewage disposal plant, to M. A. Bongiovanni, 224 Hall Ave., Syracuse, **$80,000.** Bids 10/29. CD 10/21—ENR 10/23.

Tex., Corsicana—Imprv. sanitary sewerage sys. in and near here. **WPA. $52,098.**

Ont., Camp Borden—Dpt. National Defense for Air, Ottawa, drainage work, Air Force Station, to Scott-Jackson Constr. Co. Ltd., 57 Bloor St. W., Toronto. **$32,000.**

Sask., Vanscoy—Dpt. National Defense for Air, Ottawa, Ont., sewer and water sys. at Relief Intermediate Aerodrome, to Henry Borger & Son, Ltd. 194 Osborne St., Winnipeg, Man. **$35,000.**

BRIDGES GRADE CROSSINGS

PROPOSED WORK

Calif., Marysville—State, Div. Hys., C. H. Purcell, hy. engr., P. Wks. Bldg., Sacramento, surveys, subway under tracks Southern Pacific R.R. Over $25,000.

Ill., Chicago—Cook Co., Councy Bldg., removable concrete railroad crossing with concrete devil strips, curbing, guttering, approaches, at crossings Chicago, Burlington & Quincy R.R., and St. A, Rtes. 18 plus 22, Willow Springs Rd., and Chicago & North Western R.R., and St. A. Rt. 22, Des Plaines River Rd., $30,000; installing automatic flashing light signals, Thacker St., at grade crossing Chicago & North Western R.R., Des Plaines, $3,535. G. H. Baker, Centennial Bldg., Springfield, state engr. co. roads and city streets.

★**O., Akron**—Defeated $600,000 bonds, bridge repairs, new construction, J. E. Soderberg, city engr. CD 9/16—ENR 9/18.

★**Oklahoma**—State Hy. Dpt., Oklahoma City, 4,900 ft. bridge and 4 mi. fill across Washita River and arm of the Red River Lake, between Kingston and Durant, Marshall Co. $2,000,000. V. T. Moon, c/o owner, engr.

Okla., Albion—State Hy. Dpt., Oklahoma City, preliminary plans bridge on farm-to-market road, west of here, Le Flore Co. $25,000. V. T. Moon, Capitol, Oklahoma City, engr.

Okla., Bunch—State Hy. Dpt., Capitol, Oklahoma City, preliminary plans bridge over Bunch Creek, Hy. 327, near here. $25,000. V. T. Moon, Capitol, Oklahoma City, engr.

BIDS ASKED

Bids Asked November 25

Virginia—Dpt. Hys., Richmond, T.B. bridge 11.7 mi., Rt. 122, S-678-C3, 4, J, Bedford and Franklin Counties; bridge, approaches, 48 ft., Rt. 58, SP FAP-160-DW2, B6W, DW3, and FP FAP-160 (4), Nansemond Co.

Bids Asked November 28

Minnesota—State Hy. Dpt., St. Paul, Bridge 6418, over Buffalo River, S.P. 1410-04 (Trunk Hy. 82-179); Bridges 6415, 6416 and 6417, S.P. 1410-05 (TH 82-179). E. J. Miller, bridge engr.

N. J., Kearny (br. Arlington) and **Jersey City**—Central R. R. Co. of N. J., A. E. Owen, ch. engr., Reading Terminal, Phila., Pa., altering Bridge 77, temporary railroad run-around, new piers, raising span over Hackensack River. CD 10/14—ENR 10/16.

Bids Asked December 3

California — C. H. Purcell, engr. State Hy. Dpt., P. Wk. Bldg., Sacramento, rein.-con. flat slab bridge over Kings River, near Stratford, Kings Co.

Bids Asked December 4

Calif., San Diego—State Hy. Dpt., 808 State Bldg., Los Angeles, rein.-con. box girder bridge, Washington St. at 10 Ave. Over $25,000. C. H. Purcell, hy. engr.

LOW BIDDERS

Alabama—State Hy. Dpt., Montgomery, Nov. 7, bridges, Russell Co., from Wainer Constr. Co., Valdosta, Ga., **$94,985;** bridge, Dallas Co., from Goodwyn & Murphree, Troy, **$72,638.** CD 10/29, under Roads.

Kentucky—Dpt. Hys., Frankfort, Nov. 7, steel superstructure bridge, SP 19-31, Newport-Maysville Rd., Campbell Co., from Shields Constr. Co., Lexington, **$26,806.**

†North Carolina—Pub. Roads Admin., Winder Bldg., 17 and F. Sts. N.W., Wash., D. C., Nov. 6, rein.-con. structure, stone facing, Project 2Y3, from J. M. Francesa, Fayetteville, W. Va. **$26,235.** CD 10/14—ENR 10/16.

†O., Massillon—U. S. Eng., Federal Bldg., Huntington, W. Va., Nov. 7, superstructure Pennsylvania R.R. bridge over Tuscarawas River, below Tremont Ave., from Fort Pitt Bridge Wks., Oliver Bldg., Pittsburgh, Pa. **$448,045.** Est. $500,875. CD 11/3—ENR 11/6.

STREETS AND ROADS

BIDS ASKED

Bids Asked November 25

Ia., Cedar Rapids—Linn Co., R. M. Vesely, aud., surfacing, resurfacing 36 mi. roads. $25,000. W. H. Benrens, co. engr.

★**Virginia**—Dpt. Hys., Richmond, concrete paving 1.5 mi. Rt. 13, SP S-38-W2, Accomac Co.; 0.2 mi. Rt. 211, SP S-292-M2, Fairfax Co.; waterbound macadam paving 1.2 mi. Rt. 15, SP S-469-M1, 2, 4, E, Charlotte Co.; 3 mi. Rt. 16, SP S-757-D2, Smyth Co.; 2 mi. and bridge Rt. 17, SP S-1171-C1, B4, Loudoun Co.; 5.8 mi. and bridge Rt. 55, SP S-1219-A1, B1, A2, Shenandoah and Frederick Counties; traffic bound macadam paving 4.1 mi. Rt. 40, SP FAS-728-F, B6, S-728-F2, and Federal Proj. FAS-510-F(1), Franklin Co.; curbing, guttering 0.6 mi. Rt. 172, SP S-1241-A (C & G), York Co.

Bids Asked November 26

N. Y., Kew Gardens—President Queens Boro, Queens Boro Hall, 120-55 Queens Blvd., grading, curbing, recurbing, etc., 84 Dr.; imprv. Francis Lewis Blvd. from Horace Harding Blvd. to Union Turnpike.

Bids Asked November 28

Minnesota—State Hy. Dpt., St. Paul, grading, gravel surfacing, box culverts, concrete paving 5 mi. SP 0710-06 (Trunk Hy. 83-83); stabilized gravel surfacing, grading 6.8 mi. SP 1403-02 (TH 32-177); 6.9 mi. SP 1410-02 (TH 82-179); stabilized gravel surfacing, grading, culverts 8.7 mi. SP 6014-02 (TH 102-178); 7.5 mi. SP 8711-02 (TH 75-6), SN-FAP 445 B(1); 8.5 mi. SP 6920-03 (TH 53-11) and SP 6920-02 (TH 53-11), FAPs 379 F(3) and 181 (2); drilling 125 ft. deep well, furnishing, installing water pump, Humboldt Ave. N. and Olson Memorial Hy., Minneapolis, SP 2751-23 (TH 55-188). J. T. Ellison, ch. engr.

Bids Asked December 1

Mo., Sugar Creek — Concrete and asphalt paving, constructing 10x10 ft. culverts. $110,000. Robert Schooley & Co., 1017 Locust St., Kansas City, Mo., engrs.

Bids Asked December 3

Louisiana—State Dpt. Hys., Baton Rouge, reshaping roadways, sand-clay gravel surfacing 12.738 mi. hy. between Sheridan and Bogalusa, Washington Parish.

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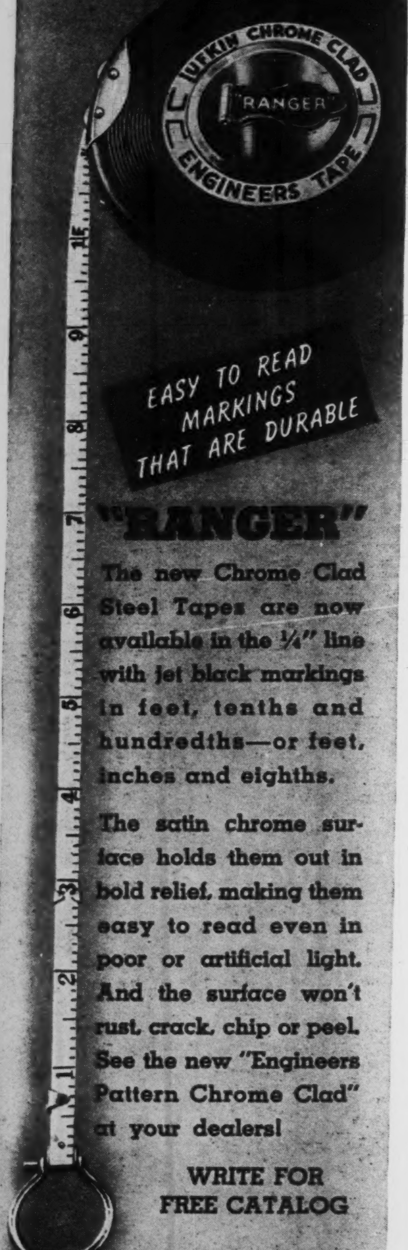

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STREETS, etc. (Bids Asked, Cont'd.)

Bids Asked

†Calif., San Francisco—Con. Q.M., Fort Mason, San Francisco, roads, sidewalks, utilities for Radio Transmitter Station WVY, Fort Winfield Scott, Inv. W-7142-42-1.

Ill., Rochelle—Blacktopping 4 mi. streets, etc. $135,000. C. K. Willett, city engr.

Washington—B. Bantz, dir. Hys., Olympia, bids soon clearing, grading, draining 2.2 mi., Primary SH 5, White Pass Branch, Yakima Co.

†Washington—Pub. Roads Admin., Post Office Bldg., Portland, Ore., rejected bids Oct. 15, grading, grubbing, etc., South Fork Stillaguamish Hy., Mt. Baker Natl. Forest, Whatcom Co. CD 10/23—ENR 10/30, under LB.

LOW BIDDERS

Alabama—State Hy. Dpt., Montgomery, Nov. 7, imprv. 10.871 mi. Tuskegee-Phenix City Rd., Russell Co., from R. H. Wright & Sons, Columbus, Ga., **$205,610*****6.741 mi. same road, Macon Co., from Vandigriff Constr. Co., 4708 N. Court St., Montgomery, **$157,300** ***8.399 mi. Dallas Co., from Hooper Constr. Co., 1125 Kings Ave., South Jacksonville, Fla., **$168,324.** CD 10/29.

Kentucky—Dpt. Hys., Frankfort, Nov. 7, imprv. 2.514 mi., Campbell Co., from The Fuller-Davies Co., Frankfort, **$96,381*****4.428 mi., Perry Co., from Harry Hatfield & Co., Barboursville, W. Va., **$136,389.** CD 10/21—ENR 10/23.

N. Y., New York—President Bronx Boro, Bronx County Bldg., 851 Grand Concourse, Nov. 12, imprv. Eastern Blvd., from Frank Mascali & Son, 4634 3 Ave. **$276,998.** CD 11/3—ENR 11/6.

CONTRACTS AWARDED

Ala., Anniston—Imprv. 26,000 sq. yd. streets, to Dunn Constr. Co., Chamber of Commerce Bldg., Birmingham. Est. **$40,000.** Bids 10/21. CD 10/8.

★**Ark., Little Rock**—City, c/o C. E. Mayer, mayor, imprv. streets, **WPA. $659,651.**

Ark., Little Rock—Judge Pulaski Co., Little Rock, imprv. roads, **WPA. $50,000.**

†Calif., Paso Robles—War Dpt., 20 St. and Constitution Ave. N.W., Wash., D. C., surfacing roads, motor vehicles park and taxiways, to J. E. Haddock, Ltd., 3578 E. Foothill St., Pasadena, **$93,103.**

Calif., San Francisco—Pacific Gas & Electric Co., 245 Market St., repaving, sidewalk work, San Francisco Div., to Lowrie Paving Co., 1540 16 St. Over **$25,000.**

Calif., San Mateo—Concrete curbs, gutters, walks, etc., San Mateo Terrace 7, Unit 1, R.1.41-19, to L. C. Smith, 1st St. and Railroad Ave. **$26,799.** Bids 11/3. CD 10/27.

Kansas—State Hy. Dpt., Topeka, Belleville, imprv. 8.085 mi. Republic Co., to Cook & Ransom, Ottawa, **$104,985;** 6.607 mi. FA 554B, Ellsworth Co., to H. J. Hall Constr. Co., Mission, **$93,854.** Bids 10/31, awarded 11/10. CD 10/22.

†Michigan—State Hy. Comn., Lansing, imprv. 1.623 mi. Washtenaw Co., to H. H. Frisinger, J. H. Porath & Sons and E. B. Schwaderer, Ypsilanti, **$88,888. DPW.** Bids 11/3. CD 10/28.

Minn., Wabasha—Wabasha Co., C. O. Larson, aud., road imprvs., **WPA. $179,130.** H. V. Jorgensen, co. hy. engr.

N. J., Garfield—Excavating, 7 in. penetration macadam repaving, 18 in. concrete storm sewers, etc., Leonard St., Grenelle and Harrison Aves., etc., **WPA. $59,233.** C. Malstrom, Orange and N. 6 Sts., Newark, WPA engr.

N. J., Nutley—Grading, storm sewers, watermains, laterals, **WPA. $61,500.** D. Shepherd, town engr.

N. J., Union City—Grading, asphalt on concrete surfacing, concrete curbs, New York Ave. from 32 to 45 Sts. **WPA. $68,181.** C. Malstrom, Orange and N. 6 Sts., Newark, WPA engr.

North Carolina—State Hy. & P. Wks. Comn., Raleigh, imprv. roads, Iredell Co., **WPA. $50,000.** W. V. Baise, Raleigh, engr.

★**Pennsylvania**—State Hy. Dpt., Harrisburg, imprv. 38,696 ft. hy., 2 rein.-con. structures, 2 plate girder, 2 rein.-con. and 2 overpass bridges, Lancaster Co., to C. W. Good, Inc., 726 Columbia Ave., Lancaster. **$839,676.** Bids 10/17, awarded 11/10. CD 10/20—ENR 10/23 under LB.

Tenn., Savannah—R. Guinn, Jr., mayor, imprv. streets, **WPA. $51,904.** R. W. Allen, engr.

Tenn., Waynesboro—R. R. Haggard, judge Wayne Co., imprv. roads, **WPA. $100,000.** G. W. Todd, engr.

†Tex., Camp Wallace—Con. Q.M., Camp Wallace, 5½ mi. road surfacing camp area, to Texas Gulf Constr. Co., Galveston, **$51,260.** Est. $60,000. Awarded 11/8.

Tex., Corpus Christi — A. C. McCaughan, mayor, grading, curbing, guttering, asphaltic concrete surfacing, to Brown & Root, Corpus Christi. **$68,167.** Est. $120,000. Bids 11/4. CD 10/28.

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STREETS, etc. (Contracts Awarded, Cont'd.)

Tex., Groesbeck—Limestone Co., c/o Judge, grading, surfacing. **WPA. $54,766.**

Alta., Lloydminster—Province of Alberta, Edmonton, grading, graveling, eliminating 2 level crossings. Vermilion Rd., day labor. **$40,000.** Dpt. P. Wks., Edmonton, engr.

N. B., Sussex—Dpt. National Defense, Ottawa, Ont., roads, Military Camp, to Rayner Constr. Ltd., 29 Commercial St., Leaside, Ont., **$47,000.** Bids 9/23. CD 9/19.

Sask., Estevan—Dpt. National Defense for Air, Ottawa, Ont., surfacing, S.F.T. School, to Bird Constr. Co. Ltd., 7 and Smith Sts., Regina. **$30,000.**

Sask., Weyburn—Dpt. National Defense for Air, surfacing, S.F.T. School, to W. B. Ramsay, 2838 College Ave., Regina, **$39,000.**

EARTHWORK WATERWAYS

PROPOSED WORK

★ **†Colorado**—Bureau Reclamation, Customhouse, Denver, rejected bids Oct. 20, Granby Dam and dikes, Colorado-Big Thompson Project, Spec. 979. Will readvertise. CD 10/22—ENR 10/30.

Ia., Iowa City—Straightening, widening Ralston Creek, imprv. sewage facilities. $93,000.

†Missouri—U. S. Eng., 601 Davidson Bldg., Kansas City, removing 40,000 yd. rock and 5,000 yd. earth from channel Missouri River between White Cloud and Atchison Bends, center of work near St. Joseph. $60,000.

N. J., Jersey City—Hudson Co., Court House, filling in lowlands, 60,000 cu. yd. earth. $94,127. WPA. C. Malstrom, Orange and N. 6 Sts., Newark, WPA engr.

★ **Okla., Pauls Valley** — Garvin Co., Pauls Valley, preliminary plans flood control works. **$500,000.**

Tex., Fort Lavaca—Voted bonds seawall, breakwater facilities. **$300,000.**

Tex., Smithville—Bastrop-Fayette Soil Conservation Dist., c/o J. M. Carmacheal, supt., Smithville, grading, drainage, rock revetments, ditching Bastrop and Fayette Counties. $150,000.

BIDS ASKED

Bids Asked December 1

New Jersey—State Bd. Commerce & Navigation, 1060 Broad St., Newark, Proj. 168, creosoted timber groins, creosoted timber bulkheads, reparing bulkhead, earth backfill placement, Sandy Hook Bay, East Keansburg, Port Monmouth and Leonardo, $75,000, CD 11/11—ENR 11/13; Proj. 170, stone breakwater, creosoted timber bulkhead, timber pile cribbing, stone toe-beam, Atlantic Ocean near Neptune Ave., Deal, $97,000, CD 10/20—ENR 10/23; Proj. 173, stone jetty with timber core wall, timber groins, Atlantic Ocean, Manasquan, $72,000; Proj. 174, bulkhead along Delaware Bay, Reeds Beach, Middle Twp., Cape May Co. $5,000; adv. ENR 11/20. CD 10/27—ENR 10/30.

O., Paulding—Van Wert and Paulding Co. Bd. Comn., imprv. Maddox, Town Creek, and Middle Creek. $17,000. D. H. Stouffer, Paulding, co. engr.

Bids Asked December 2

Ill., Winchester—Hillview Drainage & Levee Dist., C. Adams, chn., imprv. pump. plant. Over $15,000. Stanley Eng. Co., Muscatine, engrs.

Bids Asked December 4

California—State Hy. Dpt., 808 State Bldg., Los Angeles, asphaltic concrete on concrete surfacing 2 mi. Route 26, Macy to Indiana Sts., Los Angeles Co. Over $25,000. C. H. Purcell, hy engr.

Bids Asked On or About December 5

†Arkansas—U. S. Eng., Little Rock, clearing 1,100 acres in Norfolk Reservoir, North Fork River, Baxter Co., Inv. 777-42-37.

†Wash., LaConner—U. S. Eng., Insurance Bldg., Seattle, dredging 66,000 cu. yd. material from Swinomish slough, Inv. 968-42-176.

Bids Asked December 8

†Louisiana—U. S. Eng., foot of Prytania St., foundation and masonry work for rein.-con. navigation lock structure incl. steel sheet piling cut-off and retaining walls, etc., Iberville Parish, 15 mi. southwest Plaquemine.

Bids Asked On or About December 10

†Missouri—U. S. Eng., Little Rock, Ark., clearing 500 acres Clearwater Reservoir, both sides river and exten. upstream from Clearwater Dam, on Black River, Wayne and Reynolds Counties, Inv. 777-42-38.

LOW BIDDERS

N. Y., New York—Comr. Parks, at office Dpt. Parks, 64 St. and 5 Ave., Central Park, Nov. 12, Contr. X-118-141, earth fill and riprap bulkhead, etc., Sound View Park, Bronx Boro, from Tully & DiNapoli, Inc., 1 Bridge Plaza, Long Island City. **$159,577.** CD 11/3—ENR 11/6.

N. Y., North Beach—Comr. Parks, Dpt. Parks, Arsenal Bldg., Central Park, 64 St.

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EARTHWORK, etc. (Low Bidders, Cont'd.)

and 5 Ave., New York, Nov. 10, Contr. Q-84A-441, excavating materials from Jackson's Creek Drainage Channel and placing rip-rap, La Guardia Airport, from Tully & Di Napoli, Inc., 1 Bridge Plaza, Long Island City, **$16,270.** CD 10/30—ENR 11/6.

★**†Utah**—Bureau Reclamation, Provo, Nov. 10, constructing 2nd section Duchesne Tunnel, Deer Creek Diversion of Provo River Project, Spec. 1006, from Utah Constr. Co., 1st Security Bank Bldg., Ogden. **$1,156,105.** CD 10/17—ENR 10/23.

CONTRACTS AWARDED

†Arkansas and **Mississippi**—U. S. Eng., P. O. Box 97, Memphis, Tenn., 749,000 cu. yd. earthwork in Lower St. Francis Levee Dist., Ark., Upper Yazoo Levee Dist., Miss., and White River Levee Dist., Ark., to C. J. List Constr. Co., Ry. Exch. Bldg., Kansas City, Mo., **$35,638*****to H. N. Rodgers & Sons Co., 62 S. Front St., Memphis, Tenn., **$39,045*****and to Forcum-James Co., Dyersburg, Tenn., **$92,892.** Grand total $167,575. Bids 10/24. CD 10/16.

†California—Bureau Reclamation, Customhouse, Denver, Colo., furnishing conduit liners, bulkheads, test plates, etc., for river outlets, Shasta Dam, Central Valley Project, Spec. 998, to Pittsburgh-Des Moines Steel Co., 1015 Tuttle St., Des Moines, Ia., **$173,850.** Bids 10/22, awarded 11/12. CD 9/29—ENR 10/2, under Unclassified.

N. J., Jersey City—Hudson Co., Court House, 6,700 ft. 15x30 in. ditches, 6,700 ft. 12x4x6 ft. dikes, 36 in. corrugated pipe, **WPA. $57,000.** C. Malstrom, Orange and N. 6 St., Newark, WPA engr. CD 5/28—ENR 6/5.

N. J., Sewaren—Shell Oil Co., Inc., 50 W. 50 St., New York, N. Y., dredging area to 15 in. depth, Arthur Kill, 200 ft. pier exten., to Allen Spooner & Son, Inc., Pier 11, North River, New York, N. Y. **$50,000.**

Tex., Beaumont—Jefferson Co., c/o C. A. Howell, judge, excav. for outfall channel, etc., Unit 1, to Carr Constr. Co. Inc., c/o General Delivery, Dayton, O. **$17,000.** Bids 10/22. CD 10/17.

★**†Tex., Denison**—U. S. Eng., Citizens Bldg., Denison, furnishing, installing two 56,000 hp. turbines, accessories for Denison Dam Project, to S. Morgan Smith Co., 8 E. Smith St., York, Pa., **$1,134,801;** 2 sets governing equip., embedded parts, to Woodward Governor Co., Rockford, Ill., **$60,935.** CD 10/21—ENR 10/23.

Tex., Edna—Jackson Co., c/o Judge, flood control, clearing, widening Lavaca River. **WPA. $57,624.**

Tex., Houston—Harris So. Drainage Dist. 2, 16,496 lin. ft. ditching, levees, etc., to H. M. Ansley, 6714 Peerless St. Approx. **$16,000.** R. J. Putney, Houston, co. drainage engr.

UNCLASSIFIED

PROPOSED WORK

★**†Calif., Mare Island**—WAYS and SHOPS—Pub. Wks. Officer, Mare Island Navy Yard, surveys five 290 ft. double ways, machine and electric shops north of Mare Island Causeway. $7,000,000.

†Calif., Santa Maria—TARGET RANGE—Con. Q.M., 74 New Montgomery St., San Francisco, target range facilities, target houses, gas instruction chamber, etc., Camp Cooke. $300,000.

Calif., Stockton—SHIPYARD—Star Eng. Co. Inc., Stockton, 7-way shipyard, Rough and Ready Island.

Florida—RURAL ELECTRIC LINES—Wets Florida Electric Co-operative Assn., Inc., C. H. Smith, supt., Graceville, 261 mi. rural electric lines, Holmes, Jackson, Washington and Calhoun Counties. $217,000 REA allot.

Florida—RURAL ELECTRIC LINES—Escambia River Electric Co-operative, Inc., C. W. Patton, supt., Jay, 117 mi. rural electric lines, Santa Rosa and Escambia Counties. $98,000 REA allot.

Florida—RURAL ELECTRIC LINES—Talcuin Electric Co-operative, Inc., C. H. Bentley, supt., Quincy, 280 mi. rural electric lines, Gadsden, Leon, Liberty and Jefferson Counties. $330,000 REA allot.

Georgia—RURAL ELECTRIC LINES—Jefferson County Electric Membership Corp., J. B. Polhill, Jr., supt., Louisville, 232 mi. rural electric lines, Richmond, Columbia, Emanuel, Johnson, Jefferson, Jenkins, Glascock, Burke, McDuffie and Warren Counties. $185,000 REA allot.

Georgia — RURAL ELECTRIC LINES — Oconee Electric Membership Corp., P. J. Jones, acting supt., Dudley, 218 mi. rural electric lines, Bleckley, Dodge, Laurens, Wilkinson and Twiggs Counties. $181,000 REA allot.

Georgia and **Alabama**—RURAL ELECTRIC LINES—Troup County Electric Membership Corp., C. E. West, supt., La Grange, 112 mi. rural electric lines, Harris, Troup, Meri-

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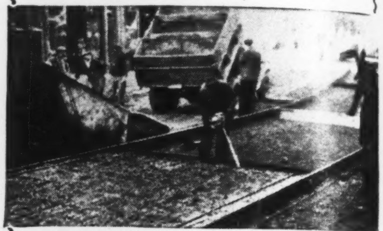

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UNCLASSIFIED (Proposed Work, Cont'd.)

weather, Heard and Muscogee Counties, Ga. and Chambers Co., Ala. $105,000. REA allot. allot.

Ga., Waycross — AIRPORT — Enlarging, imprv. municipal airport. $288,000. CAA.

Idaho, Nampa — CEMETERY IMPROVEMENTS—Grading, landscaping, etc. cemetery. $35,000.

Indiana—RURAL ELECTRIC LINES—Carroll County REMC, C. Darragh, mgr., Delphi, 62.1 mi. rural electric lines, Carroll, Cass, Clinton, Howard, Tippecanoe and White Counties. $63,000 REA allot.

Indiana—RURAL ELECTRIC LINES—Wabash County REMC G. Gordon Downey, supt., Wabash, 19.25 mi. rural electric lines, Wabash, Whitely, and Miami Counties. $28,500 REA allot.

Iowa—RURAL ELECTRIC LINES—Buena Vista County Rural Electric Co-operative, M. Nelson, supt., Storm Lake, 104 mi. rural electric lines, Buena Vista and Clay Counties. $87,000 REA allot.

Ia., Davenport—SWIMMING POOL—Voted bonds swimming pool. $145,000.

Kansas—RURAL ELECTRIC LINES—Sugar Valley Electric Co-op., Mound City, 177.35 mi. transmission lines. $160,000. REA allot. G. C. Geiger, Girard, engr.

Kansas — TRANSMISSION LINES — Ninnescah Rural Electric Co-operative, Pratt, L. Trimpe, pres., 228.62 mi. transmission lines. Reno, Pratt, Edwards, Stafford, Pawnee and Kiowa Counties. $183,000. REA allot. C. H. Guernsey, Cherokee, Okla., engr.

Kansas—RURAL ELECTRIC LINES—Coffey County Rural Electric Co-operative Assn., Inc., L. J. Pilcher, acting supt., Burlington, 142 mi. rural electric lines, Franklin, Anderson, Woodson, Greenwood, Coffey, Osage, and Lyon Counties. $111,000 REA allot.

Kansas — RURAL ELECTRIC LINES — Leavenworth Jefferson Electric Co. H. D. Harrod, pres., Leavenworth, 281 mi. rural electric lines, Jefferson, Leavenworth, Atchison and Douglas Counties. $265,000 REA allot.

Kansas—RURAL ELECTRIC LINES—Smoky Valley Electric Co-operative Assn., Inc., O. C. Hawkinson, pres., Lindsborg, 118 mi. rural electric lines, McPherson and Saline Counties. $102,000 REA allot.

Kentucky—RURAL ELECTRIC LINES—Big Sandy Rural Electric Co-operative Corp., L. Hubbard, coordinator, Prestonsburg, completing section sys. $65,000 REA allot.

Kentucky—RURAL ELECTRIC LINES—Henderson-Union Rural Electric Co-operative Corp., J. R. Hardin, supt., Henderson, 48 mi. rural electric lines, Henderson, Union and Webster Counties. $37,000 REA allot.

Kentucky—RURAL ELECTRIC LINES—West Kentucky Rural Electric Co-operative Corp., R. S. Usrey, supt., Mayfield, 117 mi. rural electric lines, Calloway, Marshall, Hickman and Carlisle Counties. $135,000 REA allot.

Michigan — GENERATING FACILITIES — Southeastern Michigan Rural Electric Co-operative Inc., Adrian, additional generating facilities. $25,000 REA allot.

Minnesota—RURAL ELECTRIC LINES—Northern Electric Co-operative Assn., F. E. Anderson, supt., Virginia, 300 mi. rural electric distr. sys., St. Louis Co. $249,000. REA allot. General Eng. Corp, 2944 Cedar Ave, Minneapolis, engrs

Nebraska—RURAL ELECTRIC LINES, etc. —McCook Public Power Dist., McCook, G. H. Myers, acting supt., 95 mi. rural electric lines, substation, Redwillow, Furnas, Frontier and Gosber Counties. $145,000 REA allot.

Nebraska—RURAL ELECTRIC LINES—Madison County Rural Pub. Power Dist., A. H. Lewis, supt., Battle Creek, 363.25 mi. rural electric lines, Antelope, Wheeler, Holt, Pierce, Boone and Madison Counties. $317,000 REA allot.

N. H., Newbury—TRAMWAY—State Aerial Tramway Comn., J. C. McLeod, chn., State House, Concord, aerial tramway up Mt. Sunapee. $375,000. H. C. Newell, 77 North Main St., Concord, engr. CD 10/27—ENR 10/30.

★**†N. J., Hoboken**—SHIP REPAIR PLANT—Tietjen & Lang Dry Dock Co., 1 Bway., New York, N. Y., bids soon ship repair plant, facilities, incl. shipways, piers, repair shops, office bldg., warehouse, utilities, for Navy Dpt. $2,000,000. Defense Plant Corp. will finance.

†N. J., Fort Monmouth—LANDSCAPING, etc.—Con. Q.M., landscaping, drainage sys., drives, etc., $70,500. WPA. W. D. Cougle, 1102 S. Broad St., Trenton, WPA and owner's engr.

N. J., Newark—STEAM PIPING—Celluloid Corp., 290 Ferry St., excavating, 3 and 6 in. steam pipes under various streets, around plant. $25,000.

New Mexico—TRANSMISSION LINES—Mora-San Migul Elec. Co-op., Mora, 173 mi. transmission lines. $177,000 REA allot. Price & Hawks, Lubbock, Tex., engrs.

N. Y., New York—PIER IMPROVEMENT—Dpt. Docks, Pier A, North River, new front, Pier 68, East River. $25,000.

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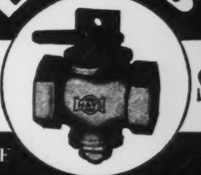
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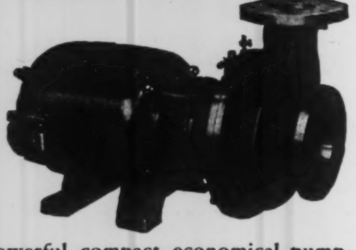

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UNCLASSIFIED (Proposed Work, Cont'd.)

★**N. Y., Stapleton**—PIER RECONSTRUCTION, etc.—Dpt. Docks, Pier A, North River, reconstructing, imprv. Piers 11-17, Foreign Trade Zone. $1,720,000.

North Carolina—RURAL ELECTRIC LINES —Cruso Electric Membership Corp., J. C. Moore, supt., Waynesville, 247 mi. rural electric lines, Haywood, Jackson, Swain and Transylvania Counties. $279,000 REA allot.

North Carolina—RURAL ELECTRIC LINES —Union Electric Membership Corp., J. S. Broome, pres., Monroe, 90 mi. rural electric lines, Union, Stanly, Mecklenburg, Rowan and Cabarrus Counties. $92,000 REA allot.

North Dakota—RURAL ELECTRIC LINES North Central Electric Co-operative, Inc., C. Lund, coordinator, Bottineau, 248 mi. rural electric lines, Bottineau, Rolette and McHenry Counties. $200,000 REA allot.

North Dakota—RURAL ELECTRIC LINES R. S. R. Electric Cooperative, Inc., R. G. Harens, coordinator, Milnor, 249 mi. rural electric lines, Richland, Ransom and Sargent Counties. $167,000 REA allot.

Ohio—RURAL ELECTRIC LINES—Buckeye Rural Electric Co-operative, Inc., Gallipolis, J. R. Lusher, supt., 312 mi. rural electric lines, Gallia, Jackson, Vinton, Meigs and Athens Counties. $330,000 REA allot.

Ohio — TRANSMISSION LINES — Marion Electric Co-op., Inc., K. Kinsler, supt., Marion, 18.6 mi. transmission lines, Wyandot, Morrow, Hardin and Marion Counties. $27,500 REA allot.

O., Cincinnati—AIRPORT—Hamilton Co., defeated $650,000 bonds, airport. H. Coates, co. engr. CD 10/21—ENR 10/23.

★**O., Cincinnati**—PLAYGROUNDS—Defeated $2,000,000 bonds, playgrounds. J. E. Root, dir. P. Wks. CD 10/21—ENR 10/23.

O, Cleveland—AIRPORT IMPROVEMENTS —F. E. Bubin, dir. Pub. Property, increase landing field, draining, grading, paving, runways. $100,000. J. Wenrick, city engr.

O., Kenton—SWIMMING POOL and BATH HOUSE—Defeated $65,000 bonds, swimming pool and bath house. P. K. Strong, city engr. CD 9/23—ENR 9/25.

★**Okla., Tulsa**—AIRPORT, etc.—Bond election Dec. 2, purchasing site and imprvs. for auxiliary airport, $50,000; purchasing property and imprvs, for exten. runways, Municipal airport, $100,000; 9 distr. sys. imprvs. $524,775. W. F. McMurray, City Hall, engr.

Pennsylvania—RURAL LINES, etc.—Adams Electric Co-operative, Inc., C. A. Gluck, supt., Gettysburg, rural light and power lines, Perry Co. Over $50,000. Gibbs & Hill, Inc., 600 N. 2 St., Harrisburg, engrs.

South Carolina—RURAL ELECTRIC LINES —Little River Electric Co-operative, Inc., F. W. Brown, supt., Abbeville, 177 mi. rural electric lines, McCormick, Anderson and Abbeville Counties. $140,000 REA allot.

South Dakota—RURAL ELECTRIC LINES —Codington-Clark Electric Assn., Inc., S. Robbins, pres., Watertown, 257 mi. rural electric lines, Codington, Clark, Hamlin and Day Counties. $200,000 REA allot.

South Dakota—RURAL ELECTRIC LINES —James River Valley Electric Assn., Groton, C. W. Wolter, pres., 181 mi. rural electric lines, Brown Co. $160,000 REA allot.

South Dakota—TRANSMISSION LINES—Hamlin Electric Assn., Hayti, G. Gunderson, coordinator, 194 mi. transmission lines. $160,000 REA allot. Banister Eng. Co., 1586 University Ave., St. Paul, Minn., engrs.

Tennessee — RURAL ELECTRIC LINES — Lincoln County Electric Membership Corp., Fayetteville, 166 mi. rural electric lines, Lincoln, Giles, Franklin, Bedford and Marshall Counties. $164,000 REA allot.

Tennessee — RURAL ELECTRIC LINES — Plateau Electric Co-operative, H. F. Cooper, pres., Oneida, 231 mi. rural electric lines, Morgan Co. $230,000 REA allot.

Texas—RURAL ELECTRIC LINES — B-K Electric Co-operative, Inc., Seymour, 147 mi. rural lines, Archer, Baylor, Throckmorton, Knox and Haskell Counties. $108,000 REA allot.

Texas—RURAL ELECTRIC LINES—Dickens County Electric Co-operative, Inc., J. M. Rose, supt., Spur, 255 mi. rural electric lines, Dickens, Kent, Stonewall and Motley Counties. $179,000. REA allot.

★**Texas**—GENERATING FACILITIES, etc. —Brazos River Transmission Electric Co-operative, Inc., 4613 Camp Bowie Blvd., Fort Worth, generating and transmission facilities. $1,000,000 REA allot.

Texas—RURAL ELECTRIC LINES—Deaf Smith County Electric Co-operative, Inc., H. V. Hennen, supt., Hereford, 213 mi. rural electric lines, Deaf Smith, Randall, Parmer and Castro Counties. $148,000 REA allot.

Texas—RURAL ELECTRIC LINES—Kimble Electric Co-operative, Inc., Junction, 314 mi. lines, Kimble, Menard, Mason and Sutton Counties. $177,000 REA allot.

Texas—RURAL ELECTRIC LINES—Swish-

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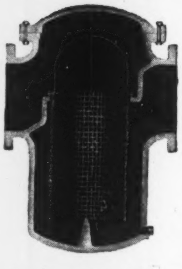

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UNCLASSIFIED (Proposed Work, Cont'd.)

er County Electric Co-operative, Inc., W. O. Dickerson, pres., Tulia, 175 mi. rural electric lines, Castro, Hale, Randall and Swisher Counties. $104,000 REA allot.

Texas and **Oklahoma**—RURAL ELECTRIC LINES—Greenbelt Electric Co-operative, Inc., O. B. Couch, supt., Wellington, 144 mi. rural electric lines, Collingsworth, Donley and Armstrong Counties, Tex., and Harmon Co., Okla. $93,000 REA allot.

Utah—RURAL ELECTRIC LINES, etc.—Garkane Power Inc., R. A. Middleton, supt., Hatch, 205 mi. rural electric lines, Garfield, Wayne, Sevier and Piute Counties. $213,000 generating plant, $140,000 REA allot.

Virginia — RURAL ELECTRIC LINES — Accomack Northampton Electric Co-operative, W. B. Irby, Jr., supt., Parksley, completing sys., installing sub-station. $66,000 REA allot.

Virginia — RURAL ELECTRIC LINES — Prince George Electric Co-operative, J. R. Allin, supt., Disputanta, 68 mi. rural electric lines, Southampton, Sussex, Surry, Prince George and Dinwiddie Counties. $86,000 REA allot.

Washington and **Idaho**—TRANSMISSION LINES—Pend Oreille Electric Co-operative, C. G. Mott, supt., Newport, Wash., 106 mi. transmission lines in Pend Oreille, Spokane and Stevens Counties, Wash., and Bonner Co., Idaho. $115,000 REA allot.

†**Wash., Bremerton** — SHIPWAYS — Puget Sound Navy Yard, 2 timber ways.

Wash., Tacoma—FISH HATCHERY—Fish hatchery, south fork Skokomish River. $50,000. C. D. Forsbeck, City Hall, engr.

Wisconsin—TRANSMISSION LINES—Bayfield Electric Co-operative, Inc., E. Maryland, pres., Iron River, 49 mi. transmission lines, Ashland Co., $43,000 REA allot.

Wisconsin—TRANSMISSION LINES—Price Electric Co-operative, Inc., C. Baldwin, supt., Phillips, 28 mi. transmission lines, Price Co. $26,000 REA allot.

Wyoming — RURAL ELECTRIC LINES — Garland Light & Power Co., H. C. Mann, acting mgr., Powell, 137 mi. rural electric lines, Park Co. $127,000 REA allot.

Man., Rivers—AIR NAVIGATION SCHOOL—Dominion Govt., Ottawa, additional accommodation, facilities, Air Navigation School. $150,000. Dpt. Air Defense, Ottawa, Ont., archts. Dpt. Munitions & Supply, Ottawa, Ont., engrs.

N. B., Penfield Ridge—AIRPORT IMPROVEMENTS—Dominion Govt., Ottowa, Ont., airport ground development $50,000. Dpt. Air Defense, Ottawa, Ont., archts. Dpt. Munitions & Supply, Ottawa, Ont., engrs.

★**Newfoundland**—AIRPORT, etc.—Dominion of Canada, Ottawa, Ont., airport and seaplane base. $500,000. Dpt. Munitions & Supply, Ottawa, Ont., engr.

Ontario—ANORTHOSITE DEPOSIT DEVELOPMENT—Syndicate, c/o Dpt. Mines, Toronto, developing anorthosite deposits on 6 mi. area, Parry Island, district of Georgian Bay. $50,000.

Ont., Barriefield — AIRFIELD, etc. — Dominion Govt., Ottawa, bids soon, developing airfield and parade grounds, Pittsburgh Twp. $70,000. Dpt. National Defense, Ottawa, Ont., engrs.

Ont., Goderich — FLYING TRAINING SCHOOL—Dominion Govt., Ottawa, additional accommodation and facilities. Elementary Flying Training School. $150,000. Dpt. Air Defense, archts., and Dpt. Munitions & Supply, engrs., both Ottawa.

Ont., Hamilton—STADIUM—Reconstructing stadium, new concrete deck. $30,000. E. H. Darling, 36 S. James St., engr. CD 8/14—ENR 8/21.

Ont., Picton—TURRET RANGE, etc.—Dominion Govt., Ottawa, turret range and cold storage chambers. $35,000. Dpt. Munitions & Supply, Ottawa, engrs.

Que., Cap de la Madeleine—HANGAR—Secy. Dpt. Munitions & Supply, Ottawa, Ont., bids soon 162x165 ft., frame overhaul hangar, concrete fdn., for Dpt. National Defense for Air, Ottawa, Ont. About $75,000.

BIDS ASKED

Bids Asked November 26

Nebraska—TRAFFIC CONTROL SIGNALS—Dpt. Roads & Irrigation, Lincoln, traffic control signals, incidental work, Omaha-Fort Crook Rd., FAP-A1-138-A (3). W. G. Scott, state engr.

Bids Asked November 28

†**California, Arizona** and **Nevada** — OIL STORAGE SYSTEMS — U. S. Eng., 751 S. Figueroa St., Los Angeles, Calif., oil storage sys., Victorville, Calif., Phoenix and Mesa, Ariz., and Las Vegas, Nev., Inv. 127. Over $25,000.

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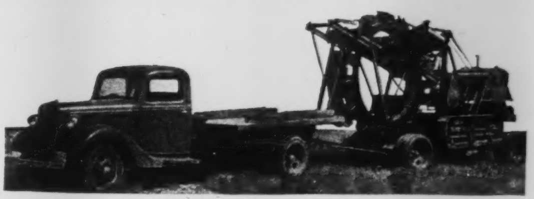

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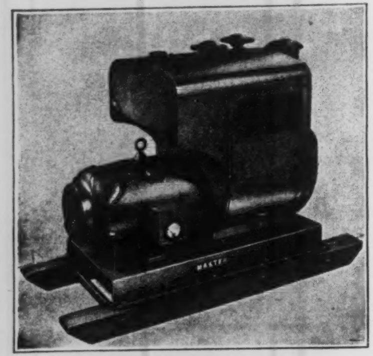

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UNCLASSIFIED (Bids Asked, Cont'd.)

★**Colorado**—RURAL TRANSMISSION LINES—Highline Electric Assn., Holyoke, 939.17 mi. transmission lines. $777,000. Extended date. Rocky Mountain Eng Co., 212 McClintock Bldg., Denver, engrs. CD 11/11—ENR 9/4.

★**Texas, Indiana, Ohio** and **Michigan** — COMPRESSOR UNITS, etc. — Panhandle Eastern Pipe Line Co., 90 Broad St., New York, N. Y., and 4002 Commerce St., Dallas, Tex., installing several compressor units along natural gas pipeline main between point near Wichita Falls, Tex., and points in Indiana, Ohio and Michigan, $1,000,000; installing 245 mi. loop pipelines to hook up to supply natural gas from Texas to points in Indiana, Ohio and Michigan, $4,000,000.

†**Wash., Longview**—SUBSTATION SWITCHGEAR—Bonneville Power Administration, P. O. Box 3537, Portland, Ore., furnishing metal-clad switchgear for substation, Inv. 2399.

Bids Asked On or About December 1

Miss., Pascagoula—AIRPORT—U. S. Eng., Federal Bldg., Mobile, Ala., clearing, grubbing, earth work, preparation subgrade, paving, storm sewers, appurtenances, light wire, conduit, CAA Airport, Spec. 569-42-287.

Texas—RURAL ELECTRIC LINES—Hall County Electric Co-operative, Inc., T. E. Lenoir, supt., 186 mi. rural electric lines Hall, Motley, Donley, Childress and Collingsworth Counties. $131,000. REA. C. C. Cox, Oliver-Eagle Bldg., Amarillo, engr. CD 11/13.

Tex., Texarkana — AIRPORT — U. S. Eng., Citizens Bank Bldg., Denison, Class 3 airport. $425,000.

Bids Asked December 4

†**Calif., San Diego** — PIER — Headquarters, 11th Naval Dist., foot of Bway., 1,000 ft. approach service pier, 60 ft. wide, Naval Operating Base, Spec. 10678.

Bids Asked December 10

†**N. M., Albuquerque**—AIRFIELD—U. S. Eng., Caddoa, Colo., airfield, warehouse, motor repair shop, oil storage house, hospitals, transmitter and control sys. for fire dpt.

Bids Asked

Tex., Beaumont—HANGAR, etc.—Jefferson Co., c/o Judge, concrete, steel hangar $175,000, 2 story administration bldg., airport, $150,000. Heartfield & Woodside, American Natl. Bank Bldg., archts. CD 5/9—ENR 5/15.

LOW BIDDERS

Ariz., Tucson—AIRPORT—U. S. Eng., 751 S. Figueroa St., Los Angeles, Calif., Nov. 10, grading, paving, Tucson Airport, from Nolan Bros., Inc., 501 Metropolitan Bank Bldg., Minneapolis, Minn., **$229,812.** CAA. CD 10/30.

Calif., Ukiah—AIRPORT—U. S. Eng., 401 Customhouse, San Francisco, Nov. 10, runway, taxiways, apron, etc., Inv. 868-42-68, Ukiah Airport, from Macco Constr. Co., 815 Paramount Blvd., Clearwater, **$143,414.** Est. $152,100. CD 11/8.

N. Y., New York — DUMPING BOARD — President Manhattan Boro, Municipal Bldg., Nov. 10, Marginal street imprvs., E. 30 to E. 49 Sts., sanitation dumping board with ramp, between E. 31 and E. 35 Sts., East River, Contr. 40A, from E. W. Foley, Inc., 16 Court St., Brooklyn. **$297,373.** CD 11/5—ENR 10/30.

O., Cleveland — TUNNEL — F. Foy, city purch. agt., Nov. 6, diversion tunnel for oil and waste, in Kingsbury Run, from Kalill Co., 4161 W. 150 St. **$451,195.** J. Wenrick, city engr. CD 10/27—ENR 10/30.

CONTRACTS AWARDED

Ala., Mobile—AIRPORT—U. S. Eng., Mobile, exten. runways, paving taxiways, municipal airport to Southeastern Constr. Co., Inc., Ozark. **$258,068.**

★†**Calif., Mare Island** — SHIPBUILDING FACILITIES—Yards & Docks, Navy Dpt., 18 St. and Constitution Ave. N.W., Wash., D. C., additional shipbuilding facilities, Navy Yard, Contr. NOY 5107, to The Kaiser Co., Box 8, Navy Yard, Mare Island. **$5,624,000.**

★†**Calif., Moffett Field**—WIND TUNNEL—National Advisory Com. for Aeronautics, Ames Laboratory, Moffet Field, fabricated steel wind tunnel, Moffett Field, to Pittsburgh-Des Moines Steel Co., Rialto Bldg., San Francisco. **$5,202,320.** Bids 8/15. CD 8/22—ENR 8/28.

†**Calif., San Francisco**—DRY DOCK BLOCKING—Pub. Wks. Officer, Mare Island Navy Yard, dry dock blocking for Navy Dry Docks, comprising 660 keel block rein.-con. piers, etc., Hunters Point, San Francisco, Spec. 10,704, to Barrett & Hilp, 918 Harrison St. **$39,208.** Bids 11/5. CD 10/24.

★†**Calif., Stockton**—AIRFIELD IMPROVEMENTS—U. S. Eng., 208 Post Office Bldg., Sacramento, landing strip, runways, taxiways, warmup apron, etc., Stockton Airfield, to A. Tiechert & Son, Inc., 1846 37 St., Sacramento, **$301,631;** miscellaneous earthwork and sub-grade preparation, to Morrison-Knudsen Co., 411 W. 5 St., Los Angeles, **$231,560.**

†**Kan., Dodge City** — AIR NAVIGATION FACILITIES — U. S. Eng., Wright Bldg., Tulsa, Okla., air navigation facilities, Dodge City Airport, Ford Co., to Valley Eng. Co., St. Charles, Ill. **$165,603.** CD 10/8.

N. J., Audubon—PARK IMPROVEMENTS—Camden Co. Park Comn., Court House, Camden, excavating, swamp reclamation, drainage, paths, landscaping, etc., Haddon Lake Park. **WPA. $183,429.** G. R. Swinton, 930 Atlantic Ave., Atlantic City, WPA engr. CD 10/28—ENR 10/30.

†**N. J., Audubon**—LANDSCAPING, etc.—Pub. Bldgs. Admin., 7 and D Sts. S.W., Wash., D. C., landscaping 80 acres, incl. artificial pool and lake, defense housing project, **WPA. $50,894.** G. R. Swinton, 930 Atlantic Ave., Atlantic City, WPA and owner's engr. CD 10/27—ENR 10/30.

N. J., Egg Harbor and **Galloway**—LIGHTING SYSTEM—Excavating, grading, lighting sys., new airport, **WPA. $55,000.** G. R. Swinton, 930 Atlantic Ave., Atlantic City, WPA engr.

†**N. J., Fort Dix**—RAILROAD, etc.—Con. Q.M., 8 mi. narrow gage railroad with ballast, ties, rails, etc., **WPA. $51,219.** W. D. Cougle, 1102 S. Broad St., Trenton, WPA and owner's engr. CD 10/28—ENR 10/30.

†**N. J., Fort Monmouth**—LANDSCAPING etc.—Con. Q.M., landscaping, excavating, grading, etc., **WPA. $62,500.** W. D. Cougle, 1102 S. Broad St., Trenton, WPA and owner's engr. CD 10/28—ENR 10/30.

N. J., New Brunswick—WELLPUMP, etc.—Rutgers University, College Ave., well pump, connections, waterlines, reforestration, caddy house, fence, etc., **WPA. $51,669.** CD 10/31—ENR 11/6.

N. J., Rutherford—LANDSCAPING, etc.—Bd. Educ., Town Hall, landscaping, excavating, draining, surfacing, walks, drains, drainage, etc. high school grounds. **WPA.** $50,077. C. Malstrom, Orange and N. 6 Sts., Newark, WPA engr.

Ore., Medford — AIRPORT IMPROVEMENT—Runway, airport. **WPA.** $67,773.

Man., Souris—AERODROME—Dpt. Transport, Ottawa, Ont., aerodrome development for S.F.T. School, grading, smoothing, fencing, hard-surface runways, taxi strips, etc., to Tomlinson Constr. Co. Ltd., 21 King St., E., Toronto, Ont., about **$490,000.**

Ont., Centralia—GROUND SERVICES, etc.—Dpt. National Defense for Air, Ottawa, ground services, additional grading, drainage, hard-surfacing taxi strips, S.F.T. School, to Armstrong Bros. Constr. Co. Ltd., Brampton. About **$75,000.**

Ont., Dunnville — AERODROME — Dpt. Transport, Ottawa, Ont., drainage, manholes taxi strip, etc., aerodrome, for S.F.T. School, to Dufferni Paving & Crushed Stone, Ltd., Fleet St. W., Toronto. About **$58,000.**

Ont., Grand Bend—GROUND SERVICES, etc.—Dpt. National Defense for Air, Ottawa, ground services, clearing, grading, smoothing, drainage, hard-surfaced taxi strip, Relief Intermediate Aerodrome, to Sterling Constr. Co. Ltd., 2392 Sandwich St. E., Windsor. About **$100,000.**

Ont., Mount Hope — HANGAR — Dpt. National Defense for Air, Ottawa, additional hangar, aerodrome, to Frid Constr. Co. Ltd., Terminal Bldg., Hamilton. **$68,000.**

Ont., St. Joseph — AERODROME — Dpt. Transport, Ottawa, Ont., developing aerodrome, Relief 2 to Centralia, incl. clearing, grubbing, grading, etc., to Johnson Bros. Co. Ltd., Brantford, about **$58,000.**

P. E. I., Mount Pleasant—AERODROME—Dpt. Transport, Ottawa, Ont., developing aerodrome, Relief 1 to Summerside, clearing, grading, stumping, grubbing, hard-surface runways, etc., to Curran & Briggs, Ltd., 203 Manning Chambers, Toronto, Ont. About **$220,000.**

Que., Beauport—SKI SLIDE—Owner, c/o G. H. Morency Road Club, Quebec City, ski slide, chalets, etc., to W. Rourke, Petite Riviere. Est. **$30,000.**

★†**Bermuda**—FUELING STATION—Yards & Docks, Navy Dpt., 18 St. and Constitution Ave. N.W., Wash., D. C., supplemental Agreement 1, additional facilities, Fueling Station, Contr. NOY 4630, to F. H. McGraw & Co. and Purdy & Henderson Co., 51 E. 42 St., New York, N. Y. **$969,000.** Additional to 2/24—ENR 2/27, under CA.

LATIN AMERICA

Mexico, Matamoros—Town, plans market, $150,000.

PUBLIC BUILDINGS

PROPOSED WORK

Ala., Dothan—Steam generating plant and turbine. $357,888. Applied for DPW funds.

Ala., Huntsville—Huntsville Housing Auth., c/o H. Johnson, chn., housing.

PUBLIC BLDGS. (Proposed Work, Cont'd.)

Ala., Sheffield — Tennessee Valley Auth., housing. CD 7/3/40—ENR 7/11/40.

†**Ala., Talladega**—City Bd. Educ., Junior High School, Docket Ala. 1-121. $130,500. **DPW.**

★**Ariz., Tucson**—Tucson Housing Auth., W. Grosetta, exec. secy., 162 unit housing for Spanish-American, Ariz.-4-1, and 30 unit for negroes, Ariz.-4-2. $817,000. USHA. R. Place, 11 E. Pennington St., archt. CD 11/11—ENR 11/13.

†**Ark., Fort Smith**—City, health center and clinic, Docket Ark. 3-122. $50,000. **DPW.**

†**Ark., Fort Smith**—Sisters of Mercy of the Female Academy of Little Rock, alterations, addns. St. Edward's Mercy Hospital, Docket Ark. 3-115. $120,000. **DPW.** CD 9/10—ENR 9/18.

†**Ark., North Little Rock**—North Little Rock Special School Dist., auditorium and cafeteria for Junior High School and Wilson School, Docket Ark. 3-109. $75,700. **DPW.** CD 10/1—ENR 10/9.

★†**Calif., Camp Callan**—Con. Q.M., 74 New Montgomery St., San Francisco, additional bldgs., facilities, Camp Callan. $2,500,000.

†**Calif., Chula Vista**—Chula Vista Union School Dist. of San Diego Co., addns. F and L Sts. Schools, Docket Calif. 4-109. $107,114. **DPW.**

†**Calif., Pismo Beach**—Con. Q.M., 74 New Montgomery St., San Francisco, recreation camp, 14 mi. southwest San Luis Obispo.

★†**Calif., Pittsburg**—Columbia Steel Co., Russ Bldg., San Francisco, imprv. steel and pig iron plant. $50,000,000. Defense Plant Corp. will finance. CD 10/23—ENR 10/30, under Industrial Bldgs.

★†**Fla., Jacksonville**—Bd. Pub. Instruction Duval Co., acting for Special Tax School Dist. 1, Venetia School, North Shore Elementary and Junior High School, South Shore Elementary and Junior High School, and Lake Shore Elementary and Junior High School, Docket Fla. 8-164. $798,500. **DPW.**

†**Fla., Panama City**—Bd. Pub. Instruction for Bay Co., acting for Special Tax School Dist. 4, Millville School addn., Docket Fla. 8-167. $31,000. **DPW.**

†**Fla., Panama City**—Bd. Pub. Instruction Bay Co., acting for Special Tax School Dist. of Panama City, Cove School addn., Docket Fla. 8-170. $45,000. **DPW.**

†**Fla., West Palm Beach**—Bd. Pub. Instruction Palm Beach County, plans by Wm. Manley King, West Palm Beach school, Docket Fla. 8-102. $63,988. **DPW.** CD 10/28—ENR 10/30.

†**Ga., Atlanta**—Con. Q.M., 494 Spring St., N.W., recreation camp.

†**Ga., Savannah**—Bd. Pub. Educ. of City of Savannah and Chatham Co., plans by William & Clark and C. W. Bergen, Liberty Bank & Trust Bldg., 2 story school, Docket Ga. 9-115. $171,000. **DPW.** CD 10/28—ENR 10/30.

Ga., Waycross — Waycross Housing Auth., plans by Cooper & Cooper, Forsyth St. Bldg., Atlanta, housing. CD 2/7—ENR 2/13.

†**Idaho, Boise**—Pub. Bldgs. Admin., 7 and D Sts. S.W., Wash., D. C., plans by F. Hummel, Eastman Bldg., 2 story, 30 x 90 ft. brick, concrete health center, Boise Junior College Campus, Docket Idaho 10-102, $45,000. **DPW.** CD 10/9—ENR 10/16.

†**Ill., East St. Louis**—Yards & Docks, Navy Dpt., 18 St. and Constitution Ave. N.W., Wash., D. C., plant for manufacture steel castings. Westcott Valve Co., 2133 Bond Ave., lessee and operator.

†**Ill., Joliet**—School Dist. 86, Will Co., school, Docket Ill. 11-118. $55,000. **DPW.**

†**Ind., Kingsbury**—Washington School Twn., La Porte Co., school, Docket Ind. 12-134. $100,000. **DPW.**

†**Kan., Wichita**—City Bd. Educ. plans by H. C. Anset, Bitting Bldg., C. C. Robinson, 540 S. Madison Ave. and R. Robt. Hibbs, 446 N. Market St., school, Docket Kan. 14-109. $172,136. **DPW.** CD 10/8—ENR 10/16.

★†**La., Belle Chasse**—Yards & Docks, Navy Dpt., 18 St. and Constitution Ave. N.W., Wash., D. C., ammunition depot to serve Navy needs in Gulf area. $2,300,000.

†**La., Pickering**—Vernon Parish School Bd., plans by Herman J. Duncan & Co., Inc., Rapides Bank Bldg., Alexandria, school, Docket La. 16-141. $40,000. **DPW.** CD 10/22—ENR 10/30.

†**Mass., Pittsfield**—Div. Defense Housing, FWA, 811 Vermont Ave. N.W., Wash., D. C., 100 defense housing units, Project 19061X. $375,000. CD 10/9—ENR 10/16.

★†**Mich., Highland Park (Br. Detroit)**—Ex-Cell-O Corp., 1200 Oakman Bl., plant for manufacture aircraft engine parts, for Navy Dpt. $498,000 for land and buildings, $1,892,000 for machinery and equip. Defense Plant Corp. will finance.

Mich., Kalamazoo—Western Michigan College plans by Malcolmson, Calder & Hammond, Griswold St., Detroit, 2 story, bsmnt., brick, steel, stone, concrete college bldg. $150,000.

★**Minn., Mankato** — Bd. Educ., Loretto M. Viegel, clk., bond election Dec. 16, 2 story, bsmnt., rein.-con., brick school. $1,100,000.

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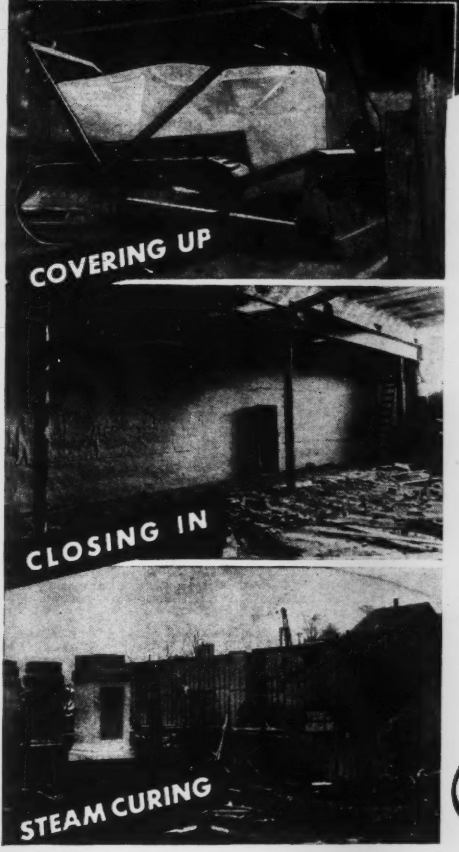

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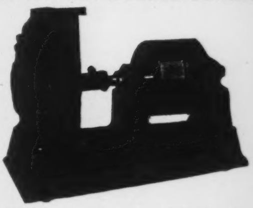

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PUBLIC BLDGS. (Proposed Work, Cont'd.)

Pass & Rockey, Mankato, archts. CD 9/4—ENR 9/11.

Miss., Clarksdale—Chamber of Commerce, J. Meadow, secy., grain elevator and storage warehouse. $250,000.

Mo., Parkville—Bd. Educ. plans by A. Kriehn, 4836 Millcreek Parkway, Kansas City, Mo., high school. $150,000. Plans application to DPW.

†Mo., St. Charles—Consolidated School Dist. 2 school, Docket Mo. 23-125. $123,500. **DPW.**

Mo., St. Louis—C. H. Ellaby, pres. Bd. Pub. Serv., City Hall, plans by A. Osburg, 301 City Hall, community headquarters bldg. Approx. $175,000. Will apply for DPW funds.

★**†Mont., West Yellowstone**—War Dpt., 20 St. and Constitution Ave. N.W., Wash., D. C., bids soon Armored Division cantonment. $22,800,000. G. H. Shanley, 1st Nat'l Bank Bldg., and J. Van Teylingen, Medical Arts Bldg., both Great Falls, archts. Henningson Eng. Co., 626 Standard Oil Co. Bldg., 18 St., and St. Marys Ave., Omaha, Neb., engrs. CD 8/5—ENR 8/7.

†Neb., Omaha—Omaha School Dist., plans by John Latenser & Sons, Inc., 1307 Farnham St., high school addn., Docket Neb. 25-108. $390,000. **DPW.** CD 9/30—ENR 10/2.

★**†Neb., Wahoo**—War Dpt., 20 St. and Constitution Ave. N.W., Wash., D. C., Nebraska Ordnance Plant for bomb loading. $25,000,000. Giffels & Vallet, Inc., 1000 Marquette Bldg., Detroit, Mich. engrs. Firestone Tire & Rubber Co., 1278 S. Main St., Akron, O., will operate. CD 10/16—ENR 10/23.

★**†N. J., Dover**—Pub. Bldgs. Admin., 7 and D Sts. S.W., Wash., D. C., rejected bids Nov. 3, 300 defense housing units, S. Salem St., Project 28101X. $1,050,000. Will readvertise. L. A. Simon, 7 and D Sts. S.W., Wash., D. C., archt CD 11/6—ENR 11/13.

†N. J., Fort Monmouth—Con. Q.M., 12 frame barracks and school bldgs. $200,000.

†N. J., Newark—Gus Reinke Mchy. & Tool Co., 63 Dickerson St., plant for manufacture ordnance equip., for War Dpt., $72,000 for land and buildings, $48,620 for equip. Defense Plant Corp. will finance.

★**N. J., Secaucus**—Hudson Co., Court House, Jersey City, plans by J. T. Rowland, Jr., 30 Journal Sq., Jersey City, hospital, addns., alterations, County Ave. $5,078,000. Applied for DPW funds. F. Sutton, 149 Broadway, New York, N. Y., engr.

★**N. Y., Brooklyn**—Dpt. Hospitals, 125 Worth St., New York, psychiatric pavilion $2,105,000 and power plant exten. $942,000, both Kings County Hospital.

★**N. Y., Brooklyn**—Dpt. P. Wks., Municipal Bldg., New York, out-patient bldg., Cumberland Hospital. $604,000.

N. Y., Brooklyn—Dpt. P. Wks., Municipal Bldg., New York, Bedford Health Center. $375,000.

N. Y., Brooklyn—Dpt. P. Wks., Municipal Bldg., New York, market, Blake Ave. $240,000.

★**†N. Y., Massena**—U. S. Eng., Massena, housing, commercial bldgs., sewage plant, etc., in connection with seaway project. Over $500,000.

N. Y., New York—Bd. Educ., 110 Livingston St., Brooklyn, altering 5 story school, 1487 Lexington Ave. $150,000. A. Rogers, c/o owner, engr.

N. Y., New York—Dpt. P. Wks., Municipal Bldg., power plant expansion, storage facilities, Harlem Hospital. $450,000.

★**N. Y., New York**—Dpt. Docks, Pier A, North River, administration bldg. Pier A, North River. $850,000.

N. Y., New York—Dpt. P. Wks., Municipal Bldg., laboratory and morgue, City Hospital, Welfare Island. $176,000.

†N. Y., North Tonawanda—City, alterations, addns. Graff Memorial Hospital, Docket N. Y. 30-101. $383,840. **DPW.** CD 12/27—ENR 1/2.

★**†N. Y., Oswego**—War Dpt., 20 St. and Constitution Ave. N.W., Wash., D. C., 4,000 man cantonment project. $3,000,000.

†N. Y., Sidney—Central School Dist. 1, Towns of Sidney, Franklin, Masonville (Delaware Co.) Unadilla (Otsego Co.) and Guilford (Chenango Co.) shop bldg. and remodeling high school, Docket N. Y. 30-102. $67,133. **DPW.**

N. Y., Springville—Bd. Educ. plans by C. C. Ade, 52 James St., Rochester, school. $150,000.

★**†N. Y., Sterlingville**—War Dpt., 20 St. and Constitution Ave. N.W., Wash., D. C., cantonment project. $12,000,000.

★**N. Y., Watertown**—Watertown Housing Auth., 168 Paddock St., housing. Over $500,000.

†N. C., Fayetteville—Cumberland Co. plans by Basil G. F. Laslett, Fayetteville, health center, Docket N.C. 31-106. $85,000. **DPW.** CD 9/4—ENR 9/11.

★**O., Cincinnati**—Approved $1,500,000 bonds, Cincinnati General Hospital addn. J. E. Root, dir. P. Wks. CD 10/21—ENR 10/23.

★**O., Cincinnati**—Approved $1,500,000 bonds, koelter, Jr., clk., 216 E. 9 St., defeated $2,000,000 bonds, vocational schools. CD 10/21—ENR 10/23.

★**O., Cincinnati**—Hamilton [illegible] defeated $400,000 bonds detention h[illegible]; defeated $1,000,000 bonds courthouse a[illegible] approved $3,500,000 bonds, county hom[illegible] H. Coates co. engr. CD 10/21—ENR 10[illegible]

O., Curtice—Allen Twp. Sch[illegible] Dist., L. Henningsen, clk., approved $1[illegible]000 bonds, centralized school. CD 8/29—EN[illegible] 9/4.

★**†O., Dayton**—Chandler-Evans Corp., South Meriden, Conn., and Dayton [illegible] plant for manufacture aircraft equip. for War Dpt. $303,124 for land and buildings, $842,003 for machinery and equip. Defense Plant Corp. will finance.

O., Jackson—Bd. Educ., C. [illegible] Mayhew, clk., brick, steel, concrete high school addn. and 3 grade school addns. $15[illegible]000. Bond issue passed. Granville E. Scott, Citizens Natl. Bank Bldg., Norwalk, arch[illegible]

O., Marion—Approved $200,000 bonds. Marion Municipal Hospital addn. C. Caldwell, dir Pub Serv. CD 9/10—ENR 9/18.

O., Port Clinton—Ottawa Co., defeated $160,000 bonds, court house annex. D. J. Missen, co. engr. CD 9/5—ENR 9/11.

O., Upper Arlington—Bd. Educ., J. W. Jones, supt., approved $177,000 bond issue school. CD 9/23—ENR 9/25.

★**O., Zanesville**—Bd. Educ., H. C. Orr, clk., defeated $1,000,000 bonds, Senior High School, repairing existing schools. CD 10/21—ENR 10/23.

†Okla., Lawton—Bd. Educ., elementary and junior high school, Docket Okla. 34-104. $90,000. **DPW.**

Okla., Tulsa—Bond election Dec. 2, reconstructing 2 fire stations, etc. $318,000. J. Koberling, 1400 S. Boston Ave., archt.

†Ore., Astoria—Lewis & Clark Consolidated School Dist. 5, plans by J. E. Wicks, 515 Commercial St., 1 story, bsmnt., rein.-con. school addn., Docket Ore. 35-106. **DPW.** CD 9/16—ENR 9/18.

†Ore., Hermiston—Union High School Dist. U-9 bids soon remodeling, constructing 30 x 60 ft. high school addn., Docket Ore. 35-10[illegible] $19,888. **DPW.** H. B. Crawford, Walla Walla Wash., archt. CD 10/9—ENR 10/16.

†Ore., Warrenton—School Dist. 30 plans by E. E. Isaacson, 120 Grand Ave., Astoria, and D. Kroeker, Failing Bldg., Portland, 2 story 25 x 26 ft. frame school addn., Docket Ore 35-111, $45,417. **DPW.** CD 10/8—ENR 10/16

★**R. I., Newport**—Newport Housing Auth., W. S. H. Dawley, chn. Health Dpt., 125 brick dwelling units. $500,000. USHA.

†R. I., Newport—Coast Guard Div. Navy Dpt., Custom House, Boston, Mass., temporary barracks, J. K. Sullivan Wharf.

★**South Carolina**—South Carolina Regional Housing Auth. No. 1, c/o Bolt & Gray attys., Laurens, 414 dwelling units, Project SC-8-1, Abbeville, Anderson, Cherokee, Chester, Edgefield, Fairfield, Greenwood, Lancaster, Laurens, McCormick, Newberry, Oconee, Pickens, Saluda, Spartanburg, Union and York Counties. $810,000 USHA loan allot.

★**South Carolina**—South Carolina Regional Housing Auth. No. II, c/o D. T. McKeithan, exec. dir., Darlington, 270 dwelling units Project SC-9-1, Chesterfield, Clarendon, Dillon, Florence, Georgetown, Horry, Kershaw, Lee, Marion, Marlboro, Sumter and Williamsburg Counties. $540,000 USHA loan allot.

★**South Carolina**—South Carolina Regional Housing Auth. No. III, c/o J. Carl Kearse, atty., Bamberg, 503 dwelling units, Project SC-10-1, Aiken, Allendale, Bamberg, Barnwell, Beaufort, Berkeley, Calhoun, Charleston, Colleton, Dorchester, Hampton, Jasper, Lexington, Orangeburg and Richland Counties. $984,600 USHA loan allot.

★**†Texas**—Monsanto Chemical Co., 1700 S. 2 St., St. Louis, Mo., plant and equip. for manufacture chemical products for synthetic rubber, in or near Galveston Co., for Rubber Reserve Co. $2,200,000. Defense Plant Corp. will finance.

Tex., Abilene—Hendrick Memorial Hospital, Abilene, plans by Hughes & Olds, Compton Bldg., Austin, hospital annex. $150,000. Applying for DPW funds.

★**†Tex., Bastrop**—War Dpt., 20 St. and Constitution Ave. N.W., Wash., D. C., cantonment type camp for housing Army Division, utilities, ground development, etc. $22,500,000. Freese & Nichols, Capps Bldg., Fort Worth, engrs. and archts. **Correction**—bid date not set. CD 10/23—ENR 10/30.

Tex., Edinburg—A. A. Aldrich, mayor, preliminary surveys constructing, equipping with diesel engine, electric power generating plant and distr. sys. $250,000.

Tex., Edinburg—Hidalgo Co., c/o J. C. Looney, judge, plans by N. W. Hardy, Nixon Bldg., Corpus Christi, 1 story, 180x446 ft., brick, hollow tile nurses home, 1 story, 41x215 ft. and 40x28 ft., isolation ward bldg., ground development, etc. $181,353. Applied for DPW funds.

†Tex., El Paso—Independent School Dist. plans by P. Bolser, El Paso, 2 story, 86x186 ft., brick, concrete Austin High School bldg unit, Tex. 41-136. $187,000. **DPW.** CD 11/7—ENR 11/13.

Tex., Fort Worth — $225,000 bond election about Nov. 18 Casa Manana building unit.

Tex., Levelland—Voted bonds municipal electric light plant and distr. sys. $275,000.

PUBLIC BLDGS. (Proposed Work, Cont'd.)

†Tex., Lubbock — Lubbock Independent School Dist., Senior High, Sanders, Roscoe, Wilson and Bean School addns., Docket Tex. 41-306. $121,600. **DPW.**

†Tex., San Antonio—U. S. Eng., Federal Bldg., Galveston, bids soon, permanent steam heating plant, etc., also temporary steam plant for Airplane Repair Dock 1, Duncan Field. $40,000.

Tex., University Park (Dallas P.O.)—Highland Park School Dist. Bd., Dallas, plans by M. Lemmon, Tower Petroleum Bldg., Dallas, school, etc., for University Park and Highland Park Districts. $200,000. Bond election soon.

†Va., Arlington—Pub. Bldg. Admin., 7 and D Sts. S.W., Wash., D. C., rejected bids Sept. 18, Navy Dpt. hydrographic office (except elevator) at Federal Office Bldg. 2. CD 9/11.

†Va., Cradock—Norfolk Co. School Bd., Portsmouth, plans by J. Binford Walford, 103 E. Cary St., Richmond, school, Docket Va. 44-163, **DPW.** CD 10/7—ENR 10/9.

★**Va., Danville**—Danville Housing Auth., housing, $750,000.

†Va., Radford—Radford Community Hospital, Inc., hospital and nurses home, plans by F. F. Stone, Roanoke, Docket Va. 44-185. $260,000. **DPW.** CD 10/22—ENR 10/30.

†Wash., Bremerton—City, plans by F. A. Naramore & Assoc., Central Bldg., Seattle, hospital and nurses home, Docket Wash. 45-124. $661,760. **DPW.** CD 10/8—ENR 10/16.

†Wash., Bremerton—School Dist. 29, c/o F. B. Stephen, archt., Smith Tower, Seattle, 1 story, frame Pleasant Valley School addn., near here. **DPW.** Docket 45-116. $22,000.

†Wash., DuPont—School Dist. 7, plans by W. Mallis, Lyon Bldg., Seattle, 1 story, 81 x 99 ft. frame, masonry school. **DPW.** Docket 45-120. $190,000. CD 9/16—ENR 9/18.

†Wash., Poulsbo—Poulsbo School Dist. 13 plans by F. B. Stephen, Smith Tower, Seattle, 1 story, L shaped, 24 x 64 x 128 ft. concrete, frame school addn. **DPW.** Wash. 45-105. $78,400. CD 9/4—ENR 9/11.

†Wash., Seattle—Con. Q.M., 1519 S. Alaskan Way, bids soon, cantonment, 6 barracks, 2 day rooms, 2 supply bldg., 2 warehouses, 2 mess halls, 2 administration bldgs., post exchange, utilities, etc., Second Interceptor Command, Fort Lawton. $300,000.

†Wash., Tacoma—U. S. Eng., Central Bldg., Seattle, plans by Young & Richardson, Central bldg., Seattle, and bids about 1st of year, 2 story administration bldg., McChord Field, near here. $120,000.

★**†W. Va., Charleston**—Carbide & Carbon Chemicals Corp., 437 East Ave., South Charleston, plant for manufacture butadiene for synthetic rubber, for Rubber Reserve Co. Approx. $3,500,000. Defense Plant Corp. will finance.

Alta., Elk Point—Election Nov. 17, to vote on electric light plant and transmission lines.

N. B., Fredericton—Dominion Govt., Ottawa, Ont., plans by Dpt. National Defense, Ottawa, Ont., hutments, etc., Woodstock Rd. $150,000.

N. S., Preston—Dominion Govt., Ottawa, Ont., plans by Dpt. Air Defense, Ottawa, Ont., R.C.A.F. establishment, operational and administrative bldgs., officers' quarters, men's hutments, boiler house, etc. $350,000. Dpt. Munitions & Supply, Ottawa, Ont., engrs.

Ont., Barriefield—Dominion Govt., Ottawa, plans by Dpt. National Defense, Ottawa, barracks for Canadian Women's Army Corp. $150,000. Dpt. Munitions & Supply, Ottawa, engrs.

Ont., Belleville—Wartime Housing Ltd., 55 York St., Toronto, bids soon housing. About $150,000.

Ont., Camp Borden—Dominion Govt., Ottawa, plans by Dpt. National Defense, Ottawa, hospital. $150,000. Dpt. Munitions & Supply, Ottawa, engrs.

Ont., London—Dominion Govt., Ottawa, barracks, facilities and services for Canadian Women's Army Corps. $150,000. Dpt. National Defense, Ottawa, archt.

Ont., Malton—Dominion Govt., Ottawa, plans by Dpt. Air Defense, Ottawa, repair shop, No. 1 Air Observers School. $50,000. Dpt. Munitions & Supply, Ottawa, Ont., engrs.

Ont., Niagara Falls—Wartime Housing Ltd., 55 York St., Toronto, bids soon 50-100 houses. $170,000.

Ont., Ottawa — Dominion Govt., Ottawa, plans by Dpt. National Defense, armories, Lansdowne Park, $400,000. Dpt. Munitions & Supply, Ottawa, engrs.

Ont., Ottawa—Ottawa Seminary Bd., c/o Rev. Rene Martin, Rideau St. seminary. $150,000.

Ont., Toronto—Secy. Dpt. Munitions & Supply, Ottawa, bids soon, brick, steel aircraft school annex, Central Technical school, Harbord and Lippincott Sts., for Dpt. National Defense for Air, Ottawa. $225,000.

Ont., Toronto—Municipality, abbatoir, Tecumseth St. $40,000.

Ont., Whitby—Wartime Housing Ltd., 55 York St., Toronto, bids soon housing units, north end. $150,000-$200,000.

Que., Cap de La Madeleine—Secy. Dpt. Transport, Ottawa, Ont., bids soon overhaul shop bldg. for Dpt. Transport and Canada Airways, Ltd., Ottawa, Ont. about $100,000.

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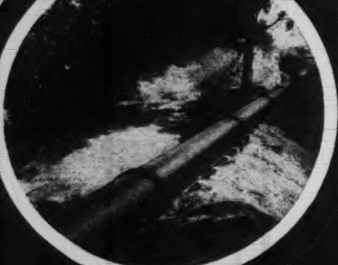

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PUBLIC BLDGS. (Proposed Work, Cont'd.)

Que., Havre St. Pierre—Province of Quebec, Quebec City, plans by Dpt. Health, Quebec City, hospital. $150,000.

Que., Hull—Dominion Govt., Ottawa, Ont., plans by Dpt. National Defense, Ottawa, Ont., frame structures, hutments and officers' quarters, concrete fdns. $150,000. Dpt. Munitions & Supply, Ottawa, Ont., engrs.

BIDS ASKED

Bids Asked After November 15

Ill., Joliet—St. Joseph's Hospital, 372 N. Bway., hospital addn. $150,000 incl. equip. L. J. Latz, 5 N. Genesee St., Waukegan, archt.

Bids Asked After November 18

Wis., Waterloo—Rebuilding municipal light and power plant. $104,000. Commercial Testing & Eng. Co., 307 N. Michigan Ave., Chicago, Ill., engr. CD 8/7—ENR 8/14.

Bids Asked November 24

†Pa., Midland—Beaver County Housing Auth., R. Bennett, chn., 119-9 St., Monaca, 30 defense housing units, Project 36060X, for USHA. A. Martsolf, G. E. Trent and H. Bradley, 9 St., Monaca, archts. E. S. Tower, Investment Bldg., Pittsburgh, engr. CD 10/23—ENR 10/30.

Bids Asked November 25

★**O., Cleveland** — Cleveland Metropolitan Housing Auth., West Mall Dr., E. J. Bohn, secy., 1,287 unit housing, Proj. Ohio 3-7. USHA. Change of date. Small, Smith & Reeb, 1508 Terminal Tower, archts. CD 11/12.

Bids Asked November 27

†Conn., New London—U. S. Coast Guard Div., Navy Dpt., 18 St. and Constitution Ave. N.W., Wash., D. C., 3 story, 46 x 180 ft., brick, steel infirmary, hospital, etc. $368,000. Shreve Lamb & Harmon, 11 E. 44 St., New York, N. Y., archts. Clark, MacMullen & Riley, 101 Park Ave., New York, N. Y., engrs. CD 7/21—ENR 7/24.

†Conn., New London—Coast Guard Div., Yards & Docks, Navy Dpt., 18 St. and Constitution Ave. N.W., Wash., D. C., boathouse, causeway, etc., Jacobs Rock. Shreve, Lamb & Harmon, 11 E. 44 St., New York, N. Y., archts.

Bids Asked November 28

N. Y., Hartford—Central School Dist., school. $150,000. Tooker & Marsh, 101 Park Ave., New York, archts. CD 5/15—ENR 5/22.

Ore., Oregon City—Clackamas Co. Housing Auth., 100 unit housing, Clackamas Heights, near here. $260,000. R. L. Morin, Pub. Serv. Bldg., Portland, archt. CD 10/22—ENR 10/30.

Tenn., Nashville—Nashville Housing Auth., 212 Warner Bldg., administration service bldgs. for James A. Cayce Homes, Proj. Tenn. 5-1 and 5-1-A and J. C. Napier Homes, Proj. Tenn. 5-2 and 5-2-A.

Bids Asked November 29

Calif., Bakersfield—Kern County Housing Auth., 3801 N. Chester Ave., 60 unit housing, Project Cal-8-1, 50 unit housing, Project Cal-8-2. USHA. CD 10/17—ENR 10/23.

Bids Asked November 30

Calif., Martinez—Contra Costa Co. Housing Auth., c/o County Clerk, Martinez, 56 unit housing, Project Cal.-11-1, Martinez 94 unit housing, Project Cal.-11-2, Pittsburg, and 36 unit housing, Project Cal.-11-3. Antioch. USHA. CD 7/24—ENR 7/31.

Bids Asked December 1

Ga., Albany—Albany Housing Auth., 48 unit housing, Project Ga-23-1 and 56 unit housing Project Ga-23-2. USHA. Change of date. CD 11/11—ENR 11/13.

Ill., Jacksonville—Morgan County Housing Auth., Jacksonville, 70 unit housing, Project Ill.-21-1. USHA. CD 6/11—ENR 6/19.

Mich., Hamtramck (br. Detroit)—Hamtramck Housing Auth., 8581 Jos. Campau Ave., 36 unit housing, Project Mich.-4-2. USHA. CD 7/24—ENR 7/31.

★**†Tex., Orange**—Orange Independent School Dist., 1 story Jr. and Sr. High School, $390,000; school bldg. unit, imprvs., steam heating plant, etc., $160,000. Tex. 41-135. **DPW.** CD 9/4—ENR 9/11.

Bids Asked December 2

Calif., Los Angeles—Los Angeles City Housing Auth., 1031 S. Bway., 800 unit housing, Project Cal.-4-5. USHA.

†Calif., San Diego — Headquarters, 11th Naval Dist., foot of Bway., two 1 story, timber frame ward bldgs., 3 story, rein.-con. sick officers' quarters and out-patient clinic, 3 story, rein.-con. subsistence bldg. addn., paving, outside services, etc., Spec. 10705.

Ind., Terre Haute—Vigo County Housing Auth., Terre Haute, 21 unit housing, Project Ind-14-1. USHA.

Pa., Monaca—Beaver County Housing Auth., 104 unit, housing, Project Pa-14-1 and 50 unit housing, Project Pa-14-2, USHA. Extended date. CD 11/11—ENR 11/13.

Bids Asked December

Ala., Dothan—Dothan Housing Auth., 1[illegible] unit housing, Project Ala-7-1 and 100 unit housing, Project Ala-7-2. USHA. Change of date. CD 11/11—ENR 11/13.

Ill., Urbana—Champaign County Housing Auth., 70 unit housing, Project Ill.-6-1 and 7[illegible] unit housing, Project Ill.-6-2. USHA.

Tex., Galveston—Galveston Housing Auth., City Hall, L. W. Henslee, exec. dir., 214 unit housing, Project Tex.-17-1. USHA. CD 10/14—ENR 10/16 under BA.

Bids Asked December

Ala., Anniston—Anniston Housing Auth., 92 unit housing, Project Ala-4-2. USHA. Extended date. CD 11/11—ENR 11/13.

N. C., Asheville—Asheville Housing Auth., 82 unit housing, Project NC-[illegible]-1. USHA. Extended date. CD 11/11—ENR 11/13.

Bids Asked December 8

Kan., Winfield—F. E. Jarvis, mayor, installing power piping, power plant. $25,000. Extended date. Black & Veatch, 4706 Bway., Kansas City, Mo., engr. CD 11/11—ENR 11/13.

Bids Asked December 9

†Ga., Savannah—Pub. Works Officer, Navy Yard, Charleston, S. C., barracks, sick bay, mess hall and galley, heating plant, brig, pier exten., renovating existing bldgs., etc., Sect. Base 4, Cockspur Island, Spec. 10595.

Miss., Tupelo—Lee County Housing Auth., Tupelo, 25 unit housing, Project Miss-6-1. USHA.

Wis., Superior—Superior Housing Auth., J. Conroy, exec. dir., 156 unit housing, Project Wis.-1-1, USHA. CD 6/24—ENR 6/26.

Bids Asked December 10

†Calif., Mare Island—Pub. Wks. Officer, Mare Island Navy Yard, 10 family apartment, Mare Island Navy Yard, Spec. 10715.

Bids Asked December 13

Mass., Boston—Boston Housing Auth., 9[illegible] housing unit, Proj. Mass. 2-10.

Bids Asked December 15

Calif., Martinez—Contra Costa Co. Housing Auth., c/o County Clerk, Martinez, 44 unit housing, Project Cal.-11-4, Brentwood. USHA. CD 7/24—ENR 7/31.

Calif., Richmond — Richmond Housing Auth., 271 10 Ave., 102 unit Nystrom Village low rent housing, Proj. Cal. 10-2. Extended date. CD 11/12—ENR 10/16.

Calif., San Francisco—Housing Auth., of San Francisco City and County, 525 Market St., 150 unit Cal.-1-10, housing project Woodland (North Beach). USHA. CD 11/7/40—ENR 11/14/40.

Ind., Fort Wayne—Fort Wayne Housing Auth., 62 unit housing, Project Ind.-3-1A and 34 unit housing, Project Ind.-3-3. USHA. CD 6/16—ENR 6/19.

T. H., Honolulu—Hawaii Housing Auth., 9[illegible] defense housing units, Project T.H.-1-4. USHA.

Bids Asked December 16

D. C., Wash.—Alley Dwelling Auth., 13[illegible] E St. N.W., Wash., D. C., 280 housing units, Project D.C. 1-3. USHA. Extended date. CD 11/11—ENR 11/13.

Bids Asked December 17

P. R., Mayaguez—Municipal Housing Auth. of Mayaguez, 337 housing units, Project 4-[illegible] USHA. Extended date. CD 11/11—ENR 11/13.

Bids Asked December 18

Colo., Denver—Denver City and County Housing Auth., City-County Bldg., 76 unit housing, Project Colo.-1-4. USHA.

Bids Asked December 19

Ark., Conway—Conway Housing Auth., 3[illegible] unit housing, Project Ark.-6-1 and 20 unit housing, Proj. Ark.-6-2. USHA. CD 9/25—ENR 10/2.

P. R., Ponce—Municipal Housing Auth. of Ponce, P. R., 200 housing units, Project P.R. 1-7. USHA. Extended date. CD 11/11—ENR 11/13.

Bids Asked December 22

P. R., Rio Piedras—Puerto Rico Housing Auth., San Juan, 256 housing units, Project P.R. 3-9. USHA. Extended date. CD 11/12.

Bids Asked December 29

Ala., Fort Payne—Fort Payne Housing Auth. W. W. Hill, chn., 48 unit, 1 and [illegible] story, brick housing, Ala. 11-1. $175,000. Extended date. M. H. Tardy, Gadsden, archt. E. J. Ladd Eng. Co., Fort Payne, engrs. CD 10/17—ENR 10/23, under BA.

Bids Asked

†Calif., Fort Ord—Con. Q. M., 3 warehouses, utilities, etc., Inv. CA 9-6665-42-7.

Conn., Greenwich—J. Gerard Tobing, supt. Schools, (selected list bidders) brick, steel, stone school, Millbank Ave. $370,000. W. B. Tubby, 444 Madison Ave., New York, N. Y., archt. Coffin & Coffin, 125 E. 46 St., New York, N. Y., archt. Philip Nichols Sunderland, 2[illegible] West St., Danbury, engr.

LOW BIDDERS

★**†N. H., Laconia**—Scott & Williams, Inc., 266 Union St., 1 story, bsmnt., brick, steel factory for manufacture aircraft equip., for

PUBLIC BLDGS. (Low Bidders, Cont'd.) War Dpt., from Brown & Matthews, Inc., 122 E. 42 St., New York, N. Y. **$300,000** for construction, total **$609,000.** Defense Plant Corp. will finance. CD 10/27—ENR 10/30.

★**O., Toledo**—Toledo Metropolitan Housing Auth., 392 Nebraska Ave., A. G. Spieker, chn., Toledo, Nov. 5, general contract 17 bldgs. and 196 unit housing, Project Ohio 6-5, from The A. Bentley & Sons Co., 201 Belmont Ave. **$730,000.** CD 11/3.

CONTRACTS AWARDED

†Ala., Gadsden—War Dpt., 20 St. and Constitution Ave. N.W., Wash., D. C., heat treating bldgs., Gadsden shell plant, to Rust Eng. Co., Martin Bldg., Birmingham, **$124,053.**

†Calif., Inglewood—North American Aviation, Inc., 5701 Imperial Hy., design and construction 2 story, 200x240 ft. office bldg. and 1 story, 200x240 ft. experimental bldg. for War Dpt., to Austin Co., 777 E. Washington Blvd., Los Angeles, approx. **$355,000.** Defense Plant Corp. will finance. CD 10/30—ENR 11/6.

†Calif., San Francisco—Con. Q.M., Fort Mason, San Francisco, central power plant changes, Letterman General Hospital, Presidio of San Francisco, to W. S. Leland Co., 55 New Montgomery St. **$33,690.** Bids 11/4. CD 10/24—ENR 10/30.

Fla., Lakeland—Lakeland Housing Auth., J. R. Wright, chn., 60 unit Westlake housing, Project Fla. 11-2, to E. T. Clauson, 1221 15 Ave. N., St. Petersburg, **$169,500.** Bids 10/30. CD 10/24—ENR 7/31.

†Maine—Con. Q.M. for Harbor Defense, Fort Preble, Portland, 2 barracks, mess hall, utilities, Cow Island, to M. Spinelli & Sons, Inc., 38 Chauncy St., Boston, Mass. **$168,000.**

†Mass., Boston—Yards & Docks, Navy Dpt., 18 St. and Constitution Ave. N.W., Wash., D. C., 3 story, 57 x 112 ft., rein.-con. storehouse for combustibles, Charlestown Navy Yard, to Thomas OConnor Co., 238 Main St., Cambridge. **$100,000.**

Mich., Houghton—A. N. Langius, State Administrative Bd., Lansing, 2 story, bsmnt., steel, rein.-con., brick, stone Chemistry Bldg. 2, for Michigan College of Mines & Technology, to A. H. Proksch, Iron Mountain, est. **$150,000.** Bowd & Munson, 409 Wilson Bldg., Lansing, archt. CD 10/6—ENR 10/9.

★**†Mo., Independence**—Remington Arms Co., Inc., Barnum Ave., Bridgeport, Conn., supplemental contract two 100x300 ft. brick bldgs. in connection with new Lake City Ordnance Plant, for War Dpt., to Walbridge-Aldinger Co. and Foley Bros., Inc., Independence. Est. **$2,000,000.** Smith-Hinchman & Grylls, Inc., 800 Marquette Bldg., Detroit, Mich., archts. Additional to CD 11/20—ENR 11/28/40, under CA

★**†N. J., East Paterson**—Wright Aeronautical Corp. 132 Beckwith Ave., Paterson, 1 and 2 story, 415 x 450 ft. and 215 x 235 ft. brick, steel, aeroplane mfg. bldgs., with connecting bridge over street, for War Dpt., to Mahony-Troast Constr. Co., 657 Main Ave., Passaic, **$2,747,800** for land and bldgs., **$2,226,400** for machinery and equip. Defense Plant Corp. will finance. Albert Kahn, Inc., 345 New Center Bldg., Detroit, Mich., archts. and engrs. CD 11/11—ENR 11/13.

N. J., Fair Lawn—Bd. Educ., Boro Hall, general contract 1 and 2 story, bsmnt., 412 ft. front, 104x143 ft. sides, brick, limestone Jr. and Sr. High School, to Leopold Auriemma, Inc., 665 Newark Ave., Jersey City, **$319,265*****plumbing, to F. A. McBride Co., 185 Ward St., Paterson, **$30,782*****steel and iron, to Lafayette Iron Wks., 649 Grand St., Jersey City, **$31,757*****heating and ventilating to H. T. Richardson, 669 Van Houten Ave., Clifton, **$49,180*****electrical work, to Badaracco Bros. & Co., 403 Washington St., Hoboken, **$28,347.** Grand total $459,331. CD 10/7—ENR 10/9.

★**†Ore., Troutdale**—Aluminum Co. of America, Gulf Bldg., Pittsburgh, Pa., 100,000,000 lb. aluminum reduction plant, for War Dpt., own forces. **$10,000,000.** Defense Plant Corp. will finance. CD 10/17—ENR 10/23.

★**†Pa., Hatboro**—Pub. Bldgs. Admin., 7 and D Sts. S.W., Wash., D. C., 300 defense housing units, Project 36251X, to Anthony P. Miller & Anthony P. Miller, Inc., 3333 Arctic Ave., Atlantic City, N. J. **$1,127,150.** CD 8/27—ENR 9/7, under LB.

★**†Pa., Media**—Pub. Bldgs. Admin., 7 and D Sts. S.W., Wash., D. C., 250 defense housing units, Site 1, Delaware Co., to Anthony P. Miller & Anthony P. Miller, Inc., 3333 Arctic Ave., Atlantic City, N. J. **$1,027,000.** CD 7/20—ENR 8/7, under LB.

Wash., Bellingham—Western College of Educ., boiler plant addn., to C. Morre & Co., Smith Tower, Seattle, **$52,900.** Bids 10/20. CD 10/24—ENR 10/30, under LB.

★**†Wis., Milwaukee** — Allis-Chalmers Mfg. Co., 1126 S. 70 St., 1 story, 500x800 ft., brick, steel supercharger bldg. and 1 story, 80x200 ft. forge plant, brick, steel, Greenfield, for War Dpt., to Siesel Constr. Co., 514 E. Ogden Ave., approx. **$975,000*****grading, to Marchese Bros., Inc., 1127 S. 1 St.*** R.R. work, to W. H. Knapp, Inc., 3202 N. 37 St. Defense Plant Corp. will finance. Bids 11/7. CD 10/31.

★**†Canal Zone**—Yards & Docks, Navy Dpt., 18 St. and Constitution Ave. N.W., Wash., D. C., supplemental Agreement 13, Contr. NOY 4164, additional facilities at N.O.B.,

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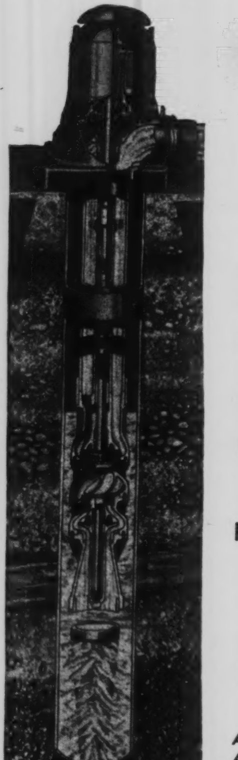

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PUBLIC BLDGS. (Contracts Awarded, Cont'd.)

Balboa; Submarine Base, Coco Solo, N.A.D., Balboa; N.A.D. Coco Solo; N.H., Balboa; N.R.S., Balboa; N.R. Sta., National Airport, David; N.R. Station, Summit, to Lindgren & Swinerton, Inc., 225 Bush St., San Francisco, Calif., Hegeman Harris Co., Inc., and Tucker McClure, 220 E. 42 St., New York, N. Y. **$2,668,320.** CD 4/4—ENR 4/10.

Ont., Ottawa—Dpt. National Defense for Air, Ottawa, bulk gasoline storage units, various R.C.A.F. Schools, to S. F. Bowser Co. Ltd., 66 Fraser St., Toronto. **$137,500.**

COMMERCIAL BUILDINGS

PROPOSED WORK

Calif., Richmond—R. L. Lippert, 2621 Lincoln Ave., Alameda, plans being completed by F. H. Slocombe, 1517 Clay St., Oakland, 1 story, rein.-con. theatre. $150,000.

★**Calif., Richmond**—Rodda Building Supply Co., 3333 El Camino Real, Palo Alto, 100 homes, vicinity Todd-California shipbuilding plant. $500,000 or more.

Calif., San Francisco—San Francisco Flower Growers' Assn., et al., 173 5 St., rein.-con. flower market. $150,000.

Me., South Portland—Modern Bldg., Inc., S. E. Merritt, mgr., 51 Clemons St., twenty 2 story, bsmnt. homes, garages. $154,000. Archt., c/o L. C. Andrew, South Windham, Me.

Minn., St. Paul — Church of the Blessed Sacrament, Rev. W. W. Finley, 1801 LaCrosse Ave., rein.-con., brick, tile, stone church, White Bear Ave. $150,000.

N. J., Englewood Cliffs—H. Nichols, Sylvan Blvd. and Hollywood Ave., 1 and 2 story, bsmnt. rustic cabin restaurant, Palisade Ave. $200,000.

★**N. Y., Forest Hills**—Dayton Realty Corp., 44 Court St., Brooklyn, plans by M. Rothstein & Son, 391 Fulton St., Brooklyn, 6 story apartment, 103-01 66 Rd. $550,000.

O., Cleveland—J. Johnson, 19256, Henry Rd., Fairview, Cleveland, 40 frame houses. $200,000.

★**O., Cleveland**—Karamu House, c/o R. W. Jeffiffe, dir., E. 38 St. and Central Ave., theatre and home. $500,000.

O., Cleveland Heights—East Boulevard & Heights Evangelical Church, David Loegler, pastor, 3544 Fairmount Bldg., Cleveland, plans by B. Dalton, 2929 Falmouth Rd., Cleveland, brick, stone, steel, concrete church. $150,000.

O., Columbus—T. A. Wildermuth, Worthington, 36 one story frame houses, 24 of which will be located between 731 and 800 Tulane Rd. $150,000.

O., Elyria — A. Bruscino, 16510 Edgecliff Ave., Cleveland, 50 homes. $225,000 or more.

O., Willoughby—Central Housing Corp., H. C. Babcox, in chg., Union Commerce Bldg., Cleveland, single housing group. $300,000.

R. I., Kingston—Cedarhurst Farms, Inc., Quonset Point, rejected bids residential development, 25 single homes, 6 apartment bldgs., North Kingston. $150,000. A. B. Mills, 1822 First St. N.W., Wash., D. C., archt.

R. I., Providence—Providence YMCA, 160 Broad St., bids in about 10 days to 2 weeks, 1 story office, 2 story, bsmnt. gymnasium, 1 story storage, brick, limestone, granite addns., YMCA Broad St. $150,000. Jackson, Robertson & Adams, 1216 Turks Head Bldg., archts. CD 10/9—ENR 10/16.

Tenn., Nashville—Crescent Amusement Co., 6 and Church Sts., plans by Marr & Holmar, Stahlman Bldg., theatre. $150,000.

Wash., Spokane—J. L. Cooper, Radio Central Bldg., 94 houses, Walton, Garland, Upton and LaCrosse Sts., in Audubon Terrace. $375,000.

Que., Quebec City—F. W. Woolworth Co., Ltd., 357 Bay St., Toronto, Ont., plans by W. Wilson, c/o owner, structural steel, brick, stone department store. $425,000.

Que., St. Marguerite du Lac Masson (P. O. La Masson)—T. Dancoste, Manoir, Ste. Marguerite, hotel and summer and winter sports resort. $150,000.

BIDS ASKED

Tex., Midland — Midland Housing Auth., 40 frame type dwellings. $150,000.

CONTRACTS AWARDED

Calif., Long Beach—Home Investment Co., 6034 Atlantic Blvd., 52 five room, frame, stucco dwellings, 1800 block, Jeanette, Ridgway and Rodley Aves. Owner builds. **$169,000.**

Calif., San Francisco — A. Berwick, 235 Brentwood Ave., 1 story, bsmnt., wood frame homes, vicinity Arnold and Crescent Aves., day labor. Over **$150,000.**

Calif., San Francisco—M. A. Little, 107 24 Ave., 1 story, bsmnt., wood frame homes, vicinity Grandview and Acme Aves. Owner builds. **$150,000** or more.

★**Conn., Fairfield**—Carl A. Anderson, Inc., 131 Sasco Hill Rd., 70 frame homes, Annie Burr Jennings Property. Owner builds. **$750,000.**

Conn., Stratford — W. McN 3757 Ma St., 41 frame homes, South Village, Plac St. Owner builds. **$250,000.**

Md., Baltimore—S. Pistorio, Winston Apt Catonsville, forty 2 story, 19x50 ft., brick attached residences, concrete block fdns. Westowne Rd., near Westshire Rd. Owne builds. **$150,000.**

Mich., Detroit—Mt. Zion American Lutheran Church, c/o Merrit & Cole, archts., 1111 Collingwood Ave., 2 story, bsmnt., brick, stone steel, rein.-con. church, to H. M. Marten Co., 2111 Woodward Ave. **$155,000.**

N. J., Fairlawn — Midland Div. Corp., 4 Church St., Paterson, 1 story, part bsmnt. 77x152 ft., brick, steel terra cotta theatre Broadway, to Weny Bros. & Storms Co., 24 Lafayette St., Paterson. **$150,000.** S. Schenker 195 Van Houten St., Paterson, archt. CD 8/22— ENR 8/28.

N. J., Passaic—Corp. c/o F. H. Taylor & Son Inc., 520 Main St., East Orange, 3 story apartment, Paulison Ave. Owner builds. **$200,000.** I. Naftali, 921 Bergen Ave., Jersey City archt. CD 11/11—ENR 11/13.

★**N. Y., Amherst** — Sheridan Woods, Inc. 1377 Main St., Buffalo, residences. Owner builds. **$1,300,000.**

N. Y., Grand Island—Corporation, c/o W F. Mullen, c/o Lamphear & Wade, 296 Delaware Ave., Buffalo, archts., 70 residences Owner builds. **$325,000.**

★**N. Y., Niagara Falls**—Charles H. Wing Co 75 Vandalia St., Buffalo, 200 residences Owner builds. **$1,000,000.**

★**N. Y., Tonawanda** — Weber Bros., 36 Main St., Eggertsville, residences. Owner builds. **$600,000.**

O., Cleveland—Company, c/o contractors, 2 single homes, garage, to Masters & Mullen Constr. Co., Chester-Twelfth Bldg. Es **$150,000.**

O., Youngstown—John and George Gran, 22 Wilson Ave., Campbell, theatre, 2703 Mahoning Ave., to F. & Y. Constr. Co., 328 E. Law St., Columbus. **$150,000.** Awarded 11/3.

R. I., North Kingston—Cederhurst Farms Inc., Quonset Point, 25 single homes, 6 apartment bldgs., 16 dwelling units, separate contracts. **$150,000.** A. B. Mills, 1822 First St N.W., Wash., D. C., archt.

★**Tex., Fort Worth**—Rockwood Development Co., c/o M. B. Settle, Waggoner Bldg 300 frame type dwellings, off Jacksboro Hy day labor. **$900,000.**

★**Tex., Houston**—E. H. Borden Co., Inc Esperson Bldg., 200 six room frame dwellings, concrete fdns., garages, etc., utilities, etc Denver addition, day labor. **$750,000.**

INDUSTRIAL BUILDINGS

PROPOSED WORK

★**Ark., Stamps** — PLANT — McKamie Gas Cleaning Co., sour gas desulphurization plant, near here. $500,000.

Calif., Lynwood—FACTORY—Western Gear Works of Calif., B. Bannan, mgr., 11,183 Long Beach Blvd., 112 x 362 ft., rigid steel, rein.-con. factory, etc. Imperial St. and Alameda St. $130,000. J. H. Davies, Ocean Center Bldg Long Beach, structural engr.

Calif., Oakland—PLANT—Richfield Oil Co 333 Montgomery St., San Francisco, completing plans steel plant addns. $40,000.

Conn., Trumbull—FACTORY, etc.—General Shaver Corp., 1 Main St., Bridgeport sketches, brick, steel, factory and office bldg. Merritt Pkwy. and Reservoir Ave. $450,000 Fletcher Thompson, Inc., 1336 Fairfield Ave Bridgeport, engr.

Ill., North Chicago—PLANT—American Steel & Wire Co., R. Buckley, asst. purch. agt Rockefeller Bldg., Cleveland, O., 1 story, 7 x 527 ft., brick, steel, electro galvanizing plant 1 story, 70 x 355 ft., brick, steel, straight and cut building. $300,000. R. Lewis, 2085 La Salle St., Chicago, engr.

Ia., Waverly — FACTORY — Waverly Beet Sugar Co., imprv. beet sugar factory. $75,000-$125,000.

Kan., Bonner Springs—FACTORY—Ozark Canning Co., Ozark, 2 story, 100x150 ft., canning factory. $45,000.

La., Algiers—PLANT—Todd-Johnson Drydock, Inc., R. J. Vanderwende, vice pres. and genl mgr., Algiers, soon lets contract 1 story 60x427 ft., brick, steel, concrete plant personnel bldg. R. Spencer Soule, 808 Perdido St New Orleans, archt.

★**La., Lake Charles**—PLANT—Mathieson Alkali Wks., Lake Charles, chlorine and sodium nitrate plant. $6,000,000, dry ice plant $250,000, ammonia and chlorine plant $1,000,000.

Mass., South Boston—FACTORY—D. J Abrahams, archt,. 260 Tremont St., Boston soon lets contract 1 story, bsmnt., 60 x 125 ft and 20 x 45 ft., brick, steel factory, Baxter and C Sts., for Cole-Hersee Co., 54 Old Colony Ave. $55,000.

INDUSTRIAL BLDGS. (Proposed Work, Cont'd.)

Mass., Westfield — WAREHOUSE, etc. — Romani's Inc., 55 Elm St., plans nearing completion, 2 story, bsmnt., 50 x 120 ft. concrete, brick, steel warehouse and store. $50,000.

Minn., LeSueur—LABORATORY, etc.—Minnesota Valley Canning Co., E. B. Cosgrove, pres., 2 and 3 story, bsmnt., 150 x 250 ft., brick, tile, structural steel, office and laboratory. $250,000.

Mo., North Kansas City—WAREHOUSE—North Kansas City Development Co., Railway Exch. Bldg., Kansas City, Mo., 1 story, warehouse, 14 and Swift Sts. $103,000. Firestone Tire & Rubber Co., 1278 Main St., Akron, O., lessees.

N. J., Elizabeth—WAREHOUSE—Armour & Co., Union Stock Yards, Chicago, Ill., beef packing warehouse, East Broad St. $50,000.

N. J., Hillside—SHOP—D. O. Evans, 1445 N. Broad St., plans by J. Wind, Jr., 1445 N. Broad St., 1 story, 65 x 185 ft., brick, steel machine and assembly shop, Evans Pl.

N. J., Newark—STOCK HOUSE—Hoffman Beverage Co., 402 Grove St., plans by Epple & Rahrs, 17 Washington St., 4 story, bsmnt., 38x62 ft. brick, steel stock house addn., Whitney St. $120,000.

N. Y., Brooklyn—MACHINE SHOP—H. M. Sushan, engr., 367 Fulton St., soon lets contract 1 story, 76x95 ft. machine shop, 90 Fulton St. for Cameron Machine Co., 61 Poplar St. $40,000. CD 10/23—ENR 10/30.

★**N. Y., Buffalo**—SMELTING PLANT—Universal Smelting & Refining Corp., 2548 Elmwood Ave., smelting plant. Over $1,000,000. The Whiting Corp., Harvey, Ill., engrs. CD 10/27—ENR 10/30.

O., Cleveland — PLANT — Cleveland Wire Spring Co., J. W. Campbell, pres., 1281 E. 38 St., 1 story, sheet metal plant addn. $40,000. G. S. Rider Co., Terminal Tower, engr.

O., Cleveland — FACTORY — Colonial Iron Wks., L. M. Stern, pres., 17643 St. Clair Ave., 1 story, 75 x 120 ft., steel, factory exten., etc. $40,000.

O., Columbus—FACTORY—Columbus Show Case Co., 850 W. 5 Ave., 100 x 100 ft. factory addn. $40,000.

O., Columbus—FACTORY—Denison Eng. Co., 119 W. Chestnut St., factory, Urlin Ave. and Dublin Rd. Over $50,000.

O., Euclid—FACTORY—Broden Constr. Co., E. J. Keller, secy. treas., 22800 Lakeland Ave., 1 story, 50x172 ft. brick steel factory addn. and 20 ton crane runway. $50,000. E. G. Hoefler, 5005 Euclid Ave., engr.

O., Jefferson—PLANT—General Electric Co., River Rd., Schenectady, N. Y., 50 x 60 ft. brick, steel, concrete plant addn. for increasing welding facilities. $50,000.

O., Malvern—MOLD SHOP—Triangle Novelty Co., mold shop, storage room, 73 ft. tunnel kiln, 3,000 gal. slip tank. Over $40,000.

O., Mansfield—FACTORY—R. B. Ridenour, 74 N. Dramond St., plans by H. J. Brumenshenkel, Walpark Bldg., 2 story, bsmnt., 40x92 ft., brick, steel factory addn. $40,000.

O., Sandusky—FACTORY—S. E. Hyman Co., factory addn., $40,000.

★**Pa., Williamsport**—PLANT—Hygrade Sylvania Corp., H. Ward Zimmer, genl. mgr., Emporium, bids late in December 2 story, bsmnt., brick, steel, concrete radio products mfg. plant. $500,000, incl. equip.

Tex., Houston—STORAGE—Mosehart & Kellar Co., 1103 San Jacinto St., auto storage, shop and service. $60,000.

★**Tex., Rusk**—PLANT—Judge B. Perkins & Associates, Rusk, iron ore plant, unit for charcoal distilling, acitic acid and wood alcohol by-products. $2,500,000. RFC loan being negotiated.

Alta., Borradaile — REFINERY — Vermilion Consolidated Oils Ltd., Vermilion, refinery. $40,000.

Alta., Mirror—RAILWAY SHOPS—Canadian National Rys., 360 McGill St., Montreal, Que., H. A. Dixon, ch. eng. (oper.) remodeling railway shops. $50,000.

B. C., Vancouver—SAW MILL—Kapoor Saw Mills, Ltd., Burrard Inlet, sawmill, log hauls, boom works, wharf and railroad track. $90,000.

B. C., Vancouver — FOUNDRY — Littler & Sons Iron Wks. Ltd., 1375 Franklin St., foundry. $40,000.

B. C., Surrey—REFINERY—Pacific Glucose Ltd., Vancouver, remodeling refinery. $40,000.

North West Territory, Yellowknife—POWER PLANT, etc.—Yellowknife Electric & Power Co. Ltd., Yellowknife, power plant, distr. sys. $40,000.

N. S., Pictou—PLANT—Pictou Fdry. & Machine Co. Ltd., remodeling portion plant for shipbuilding. $60,000.

Ont., Brantford—PLANT—W. Paterson, Ltd., Brantford, plant addn. $40,000.

Ont., Hamilton—PLANT—Brown Boggs Fdry. & Machine Co. Ltd., plant addn. $40,000.

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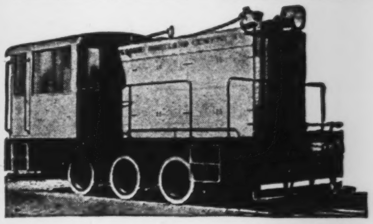

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INDUSTRIAL BLDGS. (Proposed Work, Cont'd.)

Ont., Hamilton—PLANT—Duro Aluminum Ltd., Hamilton, remodeling plant. $100,000.

Ont., Harrison—PLANT—Harrison Kist Beverages, Ltd., Harrison, aerated water mfg. and bottling plant. $40,000.

Ont., Mount Dennis—PLANT—School Publications & Specialities Co. Ltd., 66 E. King St., Hamilton, plant. $50,000.

Ont., New Toronto—PLANT—Mathers & Haldenby, archts., 96 Bloor St. W., Toronto, soon lets contract plant exten. for Campbell Soup Co. Ltd., 1 St. $150,000. CD 10/22—ENR 10/30.

Ont., Ottawa—FACTORY—Fire Killer Co. Ltd., c/o J. T. Richard, 48 Spark St., factory.

Ont., Ottawa—STORES—Secy. Dpt. Munitions & Supply, Ottawa, Ont., soon lets contract, appendix "A" stores, plant 12, for Ottawa Car & Aircraft, Ltd., 301 Slater St., $170,000.

Ont., Prescott—PLANT—F. E. Smith, Prescott, mining and reduction plant, Queen Phosphate Mine, North Burgess Twp., near here. $50,000.

Ont., Toronto—FACTORY—B. C. Plywoods, Ontario Ltd., c/o J. T. Garrow, K. C., 9 Relmar Gdnes., factory. $50,000.

Ont., Toronto—GARAGE, etc.—J. M. Lyle, archt., 230 Bloor St. W., Toronto, bids soon garage and warehouse, for Standard Brands, Ltd., Fraser St. $72,500.

Ont., Toronto—PLANT—Sunderland Oils Ltd., c/o H. M. Ford, 18 Toronto St., plant. $40,000.

Ont., Toronto—PLANT—Canada Bitters Co. Ltd., c/o J. P. Ericksen-Brown, 10 E. Adelaide St., relish, seasoning, etc. plant.

Ont., Toronto—PLANT—Century Tool & Die Wks., Ltd., c/o M. A. Wilson, 302 Bay St., plant. $40,000.

Ont., Toronto — FACTORY — Commonwealth Wool Products Ltd., c/o J. J. Burke, K. C., 1465 W. King St., factory. $50,000.

Ont., Toronto—PLANT—A. Fleury & Piersol, archts., 9 Elm St., bids soon plant addn., St. Clair Ave. W., for Canada Packers, Ltd., St. Clair Ave. W. $40,000.

Ont., Toronto — FACTORY — Genelco Ltd., c/o W. A. Campbell, 212 W. King St., factory. $40,000.

Ont., Toronto — FACTORY — Marlin Firearms Co. of Canada, Ltd., c/o D. Goodman, Federal Bldg., factory. $40,000.

Ont., Toronto—PLANT—N. A. Armstrong, archt., 19 Melinda St., soon lets contract brick, steel plant, New Toronto, near here, for Werner G. Smith, Ltd., 134 Royce Ave. $90,000 incl. equip. CD 10/8—ENR 10/16.

Ont., Toronto—FOUNDRY, etc.—Sover Gold Ore Milling Co. Ltd., c/o H. S. Honsberger, Federal Bldg., foundry and smelting plant. $40,000.

Ont., Toronto—FACTORY—Tower Woolen & Textile Co. Ltd., c/o A. Sobel, 465 Bay St., textile factory. $40,000.

Ont., Toronto—CREAMERY—Upland Dairy Co. Ltd., 744 Mount Pleasant Rd., plans by J. H. Stanford & Son, 57 Queen St. W., creamery addn. $40,000.

Ont., Welland—PLANT—Prack & Prack, archts., Pigott Bldg., Hamilton, bids soon plant addn., for Atlas Steels, Ltd., Main St.E. $75,000.

Ont., Welland—PLANT—Canada Fdry. Ltd., Welland, plant exten. $45,000.

Ont., Windsor—PLANT—Long Mfg. Ltd., 2744 Edna St., bids soon, plant addn. $60,500 incl. equip.

Ont., Woodstock—PLANT—Eureka Planter Co. Ltd., c/o H. C. Norry, Woodstock, plant exten. $40,000.

Que., Granby—PLANT—R. Vaduais, 79 Lorne St., 60x300 ft., wood, brick plant, rein.-con. fdn. $40,000.

Que., Montreal—FACTORY—Allied Roofing Products Ltd., c/o J. A. Nolan, 620 Cathcart St., factory. $40,000.

Que., Montreal—PLANT—Ascot Shirt Co., Ltd., c/o E. S. Berger, 159 W. Craig St., manufacturing plant. $40,000.

Que., Montreal—PLANT—Hamilton Generators, Ltd., c/o J. Senecal, 231 W. St. James St., plant. $50,000.

Que., Montreal—CREAMERY, etc.—Laiterie Marquette Ltd., c/o E. Langevin, civil engr., 436 Elm St., Westmount, creamery, dairy and products plant. $40,000.

Que., Montreal—PLANT—Morsam Mfg. Co. Ltd., c/o H. Batshaw, 276 St. James St. W., clothing plant. $50,000.

Que., Montreal—PLANT—Zinc Oxide Co. of Canada, Ltd., 6894 Notre Dame St. W., plant exten. $40,000.

Que., Nicolet—PLANT—La Cie de Tricot de Nicolet, Nicolet, plant exten. $40,000.

Que., Quebec City—DISTILLERY—La Distillerie Agricole Ltd., c/o L. F. Martel, 81 Commissioners St., distillery. $50,000.

Que., Riviere du Loup—PLANT—Excel Peat Ltd., Riviere du Loup, plant for manufacturing and preparing for market vegetable and mineral products.

Que., St. Hyacinthe — PLANT — Canadian United States Knitting Co. Ltd., St. Hyacinthe, plant exten. $40,000.

Que., St. Laurent (Postal Dist. Montreal)—FACTORY—Ayerst, McKenna & Harrison, 485 McGill St., Montreal, factory. $4[illegible],000.

Que., Sherbrooke—PLANT—Superheater Co. Ltd., 7 Drummond St., plant addn. $[illegible],000.

BIDS ASKED

Calif., Los Banos—PLANT—E. C. Parke, archt., Rowell Bldg., Fresno, powdered milk plant, concrete, steel, for Los Banos Creamery Assn., Los Banos. $40,000.

R. I., Bristol—WAREHOUSE, etc.—C. J. Faluge, c/o W. M. O'Rourke, archt., [illegible] Hope St., 2 story, 50 x 125 ft., brick, steel warehouse and garage, State St. $40,000. CD 10/14—ENR 10/16.

CONTRACTS AWARDED

Calif., Berkeley—PLANT—Hall-Scott Motor Car Co., 2870 7 St., plant addn., to E. T. Leiter & Sons, 811-37 St., Oakland. $49,000.

Calif., Oakland—PLANT—W. M. Boysen Co., 1001 42 St., brick plant addn., to A. A. McDonald, 3229 Ardley Ave. **$42,900.**

Calif., San Francisco—STORAGE—Struven Co., 3 St. and Arthur Ave., 1 story storage bldg., to H. E. Rahlmann, 251 Kearny St. **$60,000.**

Calif., San Francisco — STORAGE — Fruit Industries, Inc., 900 Minnesota St., additional storage quarters, to Cahill Bros., 206 Sansome St. **$40,000.**

Calif., San Jose — WAREHOUSE — Mutual Grocery Co., 961 Stockton Ave., warehouse addns., to Pasetta Constr. Co., 2390 Park Ave., Santa Clara. **$42,500.**

Calif., Vallejo—PLANT—F. Battistini, Rte. 1, Box 653, wood frame beer distr. and storage plant, day labor. **$45,000.**

Conn., Bridgeport—WAREHOUSE—Dictaphone Corp., 375 Howard Ave., 1 story, 60x200 ft., brick warehouse, Howard Ave., to Tomlinson & Hawley, 472 North Ave. Est. $40,000.

★**Conn., Devon**—POWER PLANT—Connecticut Light & Power Co., C. L. Campbell, pres., 49 Leavenworth St., Waterbury, 45,000 kw. hr. capacity power plant. Owner builds. **$4,000,000.** CD 10/3—ENR 10/10.

Conn., East Hartford—TESTING HOUSES—Pratt & Whitney Div. United Aircraft Corp., 400 Main St., two 1 story, 80x95 ft., brick, steel, concrete testing houses, etc., to Turner Constr. Co., 138 Newbury St., Boston, Mass. Est. **$55,000.** Albert Kahn Associates, Inc., 345 Center Bldg., Detroit, Mich., engr.

Ill., North Chicago — PLANT — American Steel & Wire Co., c/o R. Buckley, asst. purch. agt., Rockefeller Bldg., Cleveland, O., 1 story, brick, steel, chain link bldg., wire weaving and fuel oil storage bldgs., steel tank, to Sumner S. Sollitt & Co., 307 N. Michigan Ave., Chicago. Est. **$250,000.** R. Lewis, 2085 La Salle St., Chicago, engr.

★**Ill., Rockford**—POWER PLANT—Central Illinois Electric & Gas Co., D. C. McClure, pres., 300 N. Main St., design and construction power plant addn., to Stone & Webster Engineering Corp., 90 Broad St., New York, N. Y., **$1,350,000.**

Ia., Mason City—CANNING—J. E. Decker & Sons Packing Co., canning bldg., to Rye & Henkel Constr. Co., Inc., 525-9 St. S.E., **$94,000.**

Mass., Boston — GARAGE, etc. — Gulf Oil Corp., 31 St. James Ave., Boston, 2 story, bsmnt., 74x88 ft., concrete, brick, stone gas station, lubritorium, repair shop, office, Commonwealth Ave. and Beacon St., to McCutcheon Co., 250 Stuart St. Approx. **$40,000.** CD 12/12/40—ENR 12/19/40.

Mass., Waltham—MANUFACTURING—W. H. Nichols & Sons, 1 story, 110x120 ft. rigid frame mfg. bldg., one 2,000 lb. crane, to Austin Co., 19 Rector St., New York City. Est. **$100,000.**

Mich., Detroit—FACTORY—National Broach & Machine Co., 5600 St. Jean Ave., 1 story, brick, steel, concrete factory addn., to Barton-Mallow Co., 2631 Woodward Ave. Est. **$40,000.**

Minn., Albany—PLANT—Ward Dry Milk Plant, Albany, dry milk plant, to L. A. Borgert, 225 14 Ave. S., St. Cloud. Est. **$40,000** incl. equip.

Mo., North Kansas City—PLANT—Standard Steel Wks., 16 and Howell Sts., 115x300 ft., brick plant addn., to John H. Thompson Constr. Co., 114 W. 10 St., Kansas City, Mo. Over **$40,000.**

Mo., St. Louis—TERMINAL—Husmann & Roper Freight Lines, Inc., 1112 Mullanphy St., terminal and warehouse and office bldg., etc., brick, concrete, steel, fronting 163 ft. on Bway. by depth 205 ft., 1717 N. Bway., to Kopman Constr. Co., 722 Chestnut St. Est. **$70,000.** N. B. Howard, 722 Chestnut St., archt.

N. H., Manchester — STEAM ELECTRIC PLANT—Pub. Serv. Co., concrete, brick, steel, 10,000 kw. steam electric plant addn., Old Amoskeag Mills North Power House, to Sanders Eng. Co., Congress St., Portland, Me. Est. over **$100,000.** J. H. & J. C. Stevens, 187 Middle St., Portland, Me., archts. F. Mason, Central Maine Power Co., Green St., Augusta, Me., ch. engr.

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INDUSTRIAL BLDGS. (Contracts Awarded, Cont'd.)

N. J., Freehold—GARAGE—G. H. Marshall & Son, 50 Wayne Ave., 1 story, 70x80 ft., cinder block, steel garage and shop bldg., Freehold-Englishtown Rd., to Dotzell & Matter, West Cross St., Lakewood, **$45,000.**

N. J., Hillside — WAREHOUSE — D. O. Evans, 1445 N. Broad St., 1 story, 100x260 ft. warehouse, Evans Pl. Owner builds. **$50,000.** J. Wind, Jr., 1445 N. Broad St., archt.

†N. J., Newark—FOUNDRY, etc.—American Steel Castings Co., Edwards St. and Ave. L, 1 story, brick, steel pattern shop, machine shop and foundry addns., to Walter Kidde Constr. Co., 140 Cedar St., New York. **$200,000.** Defense Plant Corp. will finance. CD 9/23—ENR 9/25.

N. Y., Binghamton—MARKET—Thos. Mangan & C. Ely, c/o A. T. Lacey & Sons, archts., 52 Exchange St., market, to F. W. O'Connell, 329 Water St. Est. **$40,000.**

N. Y., Buffalo—FACTORY—Farnham Mfg. Co., 1646 Seneca St., factory, to H. F. Stimm, Inc., Ellicott Sq. Bldg. Est. **$40,000** with equip.

N. Y., North Tonawanda—FACTORY—Durez Plastics & Chemicals, Inc., Walsh St., factory, to George W. Morris Constr. Co., Jackson Bldg., Buffalo. Over **$40,000.** CD 4/10—ENR 4/17.

N. Y., Rochester—FACTORY—Haloid Co., 6 Haloid St., 40 x 250 ft. factory, to John Luther & Sons Co., 87 Stillson St. Est. **$40,000.** CD 11/3—ENR 11/6.

N. Y., Solsville—DAIRY—Jetter Dairy Co., 43 Perry St., New York, 50 x 150 ft. dairy to A. Russo, 2114 E. 2 St., Brooklyn. Est. **$40,000** with equip. E. H. Paull, 82 Livingston St., Brooklyn, engr.

O., Cleveland—BAKERY—Fisher Bros. Co., J. O. Salmon, pres., 2323 Lakeside St., 2 story, 54x69 ft. bakery, and 1 story 22x134 ft., brick, steel shipping room, to Sam W. Emerson Co., 1836 Euclid Ave. Est. **$40,000.** Awarded 11/6. G. S. Rider Co., 3800 Terminal Tower, archt. and engr.

O., Cleveland—FACTORY—Ohio Tool Co., L. Butzman, pres., 3160 W. 106 St., 2 story, 30x190 ft., brick, steel factory, to J. L. Hunting Co., Ninth-Chester Bldg. Est. **$75,000.** Awarded 11/4. W. Hatch, Hippodrome Bldg., engr.

O., Cleveland—FACTORY—Steel Imprvt. & Forge Co., E. 65 and Addison Sts., 1 story, 60 x 175 ft., brick steel factory addn., to J. L. Hunting Co., Ninth, Chester Bldg. Est. **$50,000.** Awarded 11/10. W. Hatch, Hippodrome Bldg., engr.

R. I., Phillipsdale—WAREHOUSE, etc.—Bird & Son, Inc., East Walpole, Mass., 1 story, 155x360 ft., brick warehouse and dryer bldg., to Vappi & Co., Inc., 240 Sidney St., Cambridge, Mass. Est. **$125,000.** Bids 10/22. CD 10/21—ENR 10/23.

Tex., Corpus Christi—MARINE SERVICE STATION PUMPING UNITS, etc.—Gulf Oil Co., Corpus Christi, 4 marine service station pump. units and tanks, etc. Owner builds. Approx. **$40,000.**

Tex., Texas City—OIL STORAGE TANKS—Southport Petroleum Co., Texas City, steel oil storage tanks. Owner builds. **$70,000.** CD 12/19/40—ENR 12/26/40.

W. Va., Alloy—PLANT—Electro Metallurgical Co., Alloy, 2 story, 42x60 ft. and 60x60 ft. plant addns., to Hughes-Foulkrod Co., Schaaf Bldg., Phila., Pa. Est. **$40,000** with equip. G. Lardie, 137 4 St., Niagara Falls, N. Y., engrs.

Man., Winnipeg—PLANT—Building Products Ltd., 3 Midland St., 1 story, bsmnt., 120x288 ft., rein.-con. plant, rein.-con. fdn., Point Douglas, to Beaver Constr. Co. Ltd., 203 McIntyre Bldg. **$47,563.** Est. $40,000. Green-Blankenstein-Russell & Ham, 610 Paris Bldg., archts.

Ont., Copper Cliff—WAREHOUSE—International Nickel Co. of Canada, Ltd., 25 W. King St., Toronto, 60 x 60 ft., concrete, stone, brick warehouse exten., to Harper Bros., 23 Nickel St., Sudbury. Est. **$90,000.**

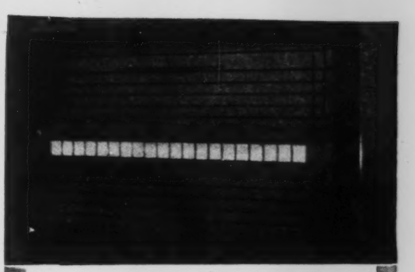
Ont., Merritton — MILL — Alliance Paper Mills, Merritton, altering plant, etc., to Redfern Constr. Co. Ltd., 36 Toronto St., Toronto. **$250,000** incl. equip. CD 10/31—ENR 11/6.

Ont., Midland—POWER PLANT—Canada Steamship Lines, Ltd., 715 Victoria Sq., Montreal, Que., reconstructing power plant, to Russell Constr. Co. Ltd., Harbour Comn. Bldg., Toronto.

Que., La Malbaie—PLANT—Donohue Bros. Ltd., La Malbaie, pulp and paper plant exten., to G. A. Gruninger, 1001 Laviolette St., Three Rivers. J. Stadler, 117 Ste. Catherine St., W., Montreal, engr.

Que., Montreal—GARAGE REPAIR SHOP—Canadian Pacific R.R. J. E. Armstrong, ch. engr., Windsor Sta., 1 story, 60 x 190 ft., brick, concrete garage repair shop, Nolan St., to W. G. Hunt Co. Ltd., 1405 Bishop St. **$46,000.** CD 7/17—ENR 7/25.

Que., Montreal—PLANT—Victory Tool & Machine Co. Ltd., 250 Rose de Lima St., 2 story, 48x80 ft., plant addn., concrete fdn., to M. Lacocq, 5535 Western Ave., about **$45,000.** P. M. Lemieux, 760 Victoria Sq., archt.



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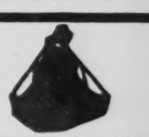

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Waterway Improvements

STATE OF NEW JERSEY
BOARD OF COMMERCE AND NAVIGATION
STATE HOUSE
TRENTON, NEW JERSEY

Sealed bids will be received separately for each of the following projects at the office of the Board of Commerce and Navigation, State House, Trenton, New Jersey, at 11:30 A.M.. Monday, November 24, 1941, and then publicly opened and read aloud.

PROJECT NO. 162:

For the construction of creosoted timber bulkhead and repair of jetty in Shark River in the Borough of Avon, County of Monmouth, New Jersey.

The amount of funds estimated at this date as available to finance this project is $60,000.00.

PROJECT NO. 163:

For the construction of creosoted timber bulkhead and appurtenances in Bayhead-Manasquan Canal, Borough of Point Pleasant, Ocean County, New Jersey.

The amount of funds estimated at this date as available to finance this project is $45,000.00.

PROJECT NO. 164:

For the dredging of the Inland Waterway Channel and/or anchorage basin in the Manasquan River, vicinity of Cook's Creek and Will's Hole Thorofare, Borough of Point Pleasant Beach, Ocean County, New Jersey.

The amount of funds estimated at this date as available to finance this project is $28,000.00.

PROJECT NO. 165:

For the dredging of the Inland Waterway Channel in two sections: Section No. 1 in Little Bay, from Main Marsh Thorofare to Black Point; Section No. 2 in Reed Bay, from Meadow Cut to Flat Thorofare, in Galloway Township, Atlantic County, New Jersey.

The amount of funds estimated at this date as available to finance this project is $55,250.00.

PROJECT NO. 166:

For the dredging of the Inland Waterway Channel and/or anchorage basin in Clam Creek from the foot of Delaware Avenue to the foot of Massachusetts Avenue, City of Atlantic City, County of Atlantic, New Jersey.

The amount of funds estimated at this date as available to finance this project is $60,000.00.

PROJECT NO. 167:

For the dredging of the Inland Waterway Channel and removal of shoal areas in Broad Thorofare, vicinity of Longport, Atlantic County, New Jersey.

The amount of funds estimated at this date as available to finance this project is $37,250.00.

PROJECT NO. 171:

For rebuilding existing stone and steel core-wall jetty by stone placement in Atlantic Ocean, at East End Avenue, Borough of Avon-by-the-Sea, Monmouth County, New Jersey.

The amount of funds estimated at this date as available to finance this project is $27,200.00.

PROJECT NO. 172:

For Class No. 1: The rebuilding and extension of existing steel core and stone fill jetty by stone placement; and Class No. 2: Optional construction of a timber fishing pier in the Atlantic Ocean near the end of Eighth Avenue in the Borough of Belmar, Monmouth County, New Jersey.

The amount of funds estimated at this date as available to finance this project is $36,500.00 for Class No. 1 (Jetty), and $15,000.00 for Class No. 2 (Fishing Pier).

Plans and specifications may be viewed at the office of the Board of Commerce and Navigation at No. 1060 Broad Street, Newark, New Jersey, or in the State House, Trenton, New Jersey, or will be furnished persons upon request at the Newark Office.

No proposal will be considered unless accompanied by cash or a certified check made payable to the Board of Commerce and Navigation of New Jersey in the amount of 5% of the total amount bid for the project. The bid deposits received with the three lowest bids may be held for forty-five (45) days after the opening of bids or until forty-eight (48) hours after the accepted bidder has executed the contract and filed the required performance surety bond. All other bid deposits will be returned within three days after the opening of bids.

The accepted bidder will be required to furnish a performance bond in the amount of the contract in accordance with Section 2:60–207 to 2:60–212 inclusive, Revised Statutes, and with sureties satisfactory to the State of New Jersey.

The Board of Commerce and Navigation reserves the right to waive any informalities in or to reject any or all bids.

FRANK D. HOLMES
Director and Secretary
November 7, 1941

Bids: December 1 (667)

Waterfront Construction

STATE OF NEW JERSEY
BOARD OF COMMERCE AND NAVIGATION
STATE HOUSE
TRENTON, NEW JERSEY

Sealed Bids will be received separately for each of the following projects at the office of the Board of Commerce and Navigation, State House, Trenton, New Jersey, at 11:30 A.M., Monday, December 1, 1941, and then publicly opened and read aloud:

PROJECT NO. 168

For construction of creosoted timber groins and creosoted timber bulkheads, repairs to existing bulkhead, and earth backfill placement in Sandy Book Bay at East Keansburg, Port Monmouth and Leonardo, Township of Middletown, Monmouth County, New Jersey.

The amount of funds etimated at this date as available to finance this project is $75,000.00.

PROJECT NO. 170

For construction of stone breakwater, creosoted timber bulkhead, timber pile cribbing and stone toe-berm in Atlantic Ocean, vicinity Neptune Avenue, Borough of Deal, Monmouth County, New Jersey.

The amount of funds estimated at this date as available to finance this project is $97,000.00.

PROJECT NO. 173

For construction of stone jetty with timber core wall and timber groins in Atlantic Ocean, Borough of Manasquan, Monmouth County, New Jersey.

The amount of funds estimated at this date as available to finance this project is $72,000.00.

PROJECT NO. 174

For construction of bulkhead along Delaware Bay at Reeds Beach in Middle Township, Cape May County, New Jersey.

The amount of funds estimated at this date as available to finance this project is $5,000.00.

Plans and specifications may be viewed at the office of the Board of Commerce and Navigation at No. 1060 Broad Street, Newark, New Jersey, or in the State House, Trenton, New Jersey, or will be furnished persons upon request at the Newark Office.

No proposal will be considered unless accompanied by a certified check made payable to the Board of Commerce and Navigation of New Jersey, in the amount of 5% of the total amount bid for the project. The bid deposits received with the three lowest bids may be held for thirty (30) days after the opening of bids or until forty-eight (48) hours after the accepted bidder has executed the contract and filed the required performance surety bond. All other bid deposits will be returned within three days after the opening of bids.

The accepted bidder will be required to furnish a performance bond in the amount of the contract in accordance with Section 2:60-207 to 2:60-212 inclusive, Revised Statutes, and with sureties satisfactory to the State of New Jersey.

The Board of Commerce and Navigation reserves the right to waive any informalities in or to reject any or all bids.

FRANK D. HOLMES,
Director and Secretary.
November 14, 1941.

U. S. Government

WAR DEPARTMENT: Office of the Constructing Quartermaster, Camp Livingston, Alexandria, La. Sealed bids will be received at this office until 2:00 P.M., C.S.T., November 28, 1941, and then publicly opened, for furnishing all labor and materials and performing all work for the *construction complete of a Water Supply Works and Purification Plant at and in vicinity of Camp Livingston, La.* The proposed work includes: Contract No. 1: Comprising the construction of electrical feeder circuit, approximately 6,600 feet in length and a 6,900 volt electrical transmission line, approximately 30,000 feet in length. Contract No. 2: Comprising the construction of a low-head timber dam and a four million gallon per day pumping station. Contract No. 3: Comprising the construction of a 20 inch cast iron raw water supply force main, approximately 30,000 feet in length and a 20 inch cast iron water flow line approximately 6,600 feet in length. Contract No. 4: Comprising the construction of a Water Purification Plant consisting of aeration, chemical treatment, sedimentation, coagulation, filtration and an elevated wash water storage tank, with a nominal rated plant capacity of four million gallons per day. Plans and specification for each contract available upon receipt of certified check in amount of $25.00 made payable to the "Treasurer of the United States." Further information upon application. (666).

WAR DEPARTMENT: U. S. Engineer Office, 613 Federal Building, Detroit, Michigan. Sealed bids will be received until 11:00 o'clock a.m., Eastern Standard Time, November 25, 1941, and then publicly opened for furnishing all labor and materials and performing all work for the *construction of one Bachelor Officers' Quarters with Mess Building* and all utilities thereto; one Ordnance Magazine; and one Storehouse and all utilities thereto; gravel roads and fencing; and doing the clearing and grubbing necessary for the preparation of the site at Camp Skeel, three miles northwest of Oscoda, Iosco County, Michigan. Further information on application. (663)

(Continued on page 157)

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